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OUTLINE OF PLANS

(WITH ILLUSTRATIONS)

FOR FURNISHING

AN ABUNDANT SUPPLY OF WATER

TO

THE CITY OF NEW YORK,

FROM A SOURCE INDEPENDENT OF THE CROTON WATER-SHED,

DELIVERED INTO THE LOWER PART OF THE CITY UNDER PRESSURE SUFFICIENT

FOR

DOMESTIC, SANITARY,

COMMERCIAL AND MANUFACTURING PURPOSES,

AND FOR

THE EXTINGUISHMENT OF FIRES,

WITH LEGAL AND ENGINEERING AND OTHER PAPERS.

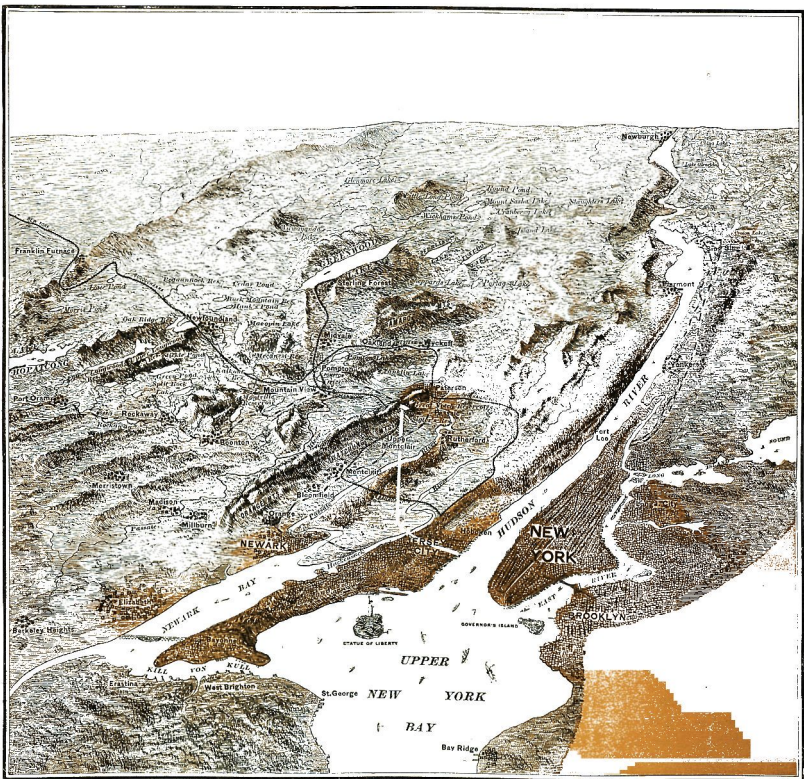
JOHN R. BARTLETT AND ASSOCIATES.

1888.

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VIEW OF THE
MOUNTAINS, LAKES, RIVERS AND STREAMS

IN ROCKLAND AND ORANGE COUNTIES,

IN THE

STATE OF NEW YORK,

AND BERGEN, PASSAIC AND MORRIS COUNTIES,

IN THE

STATE OF NEW JERSEY,

ALL LYING IN THE PASSAIC WATER-SHED;

Showing the sources of pure water supply for Paterson, Montclair, the Cities of Passaic, Newark, Jersey City and surrounding Towns east and south of Orange Mountains, and the southern part of the Cities of New York and Brooklyn.

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AREA OF

PASSAIC WATERSHED

ABOVE THE GREAT FALLS

877 SQ. MILES

AREA OF

CROTON WATERSHED

361.82 SQ. MILES

CONNECTICUT

S.D.



ISLAND

LONG I. CITY

BROOKLYN

L O W E R
B A Y

SANDY HOOK

A T L A N T I C
O C E A N
SANDY HOOK

ENGRAVED BY AMERICAN BANK NOTE CO., N. Y.

DRAWN FROM PLANS FURNISHED BY & FOR J. R. BARTLETT

COLUMBIA
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NEW YORK, November 30th, 1888.

TO THE HONORABLE COMMISSIONERS OF THE SINKING FUND OF
THE CITY OF NEW YORK.

GENTLEMEN: I respectfully call your attention to the great need of this City for an additional supply of water for domestic use, sanitary purposes and for the requirements of commerce and manufactures, and herewith submit for your consideration a proposition to furnish from sources independent of the Croton water-shed an ample quantity of pure and wholesome water, not less than 50,000,000 gallons daily, or such larger quantity as may be desired to meet these demands, delivered under pressure, into the lower part of the City, from the storage reservoirs and sources of supply of The Society for Establishing Useful Manufactures, of the Lehigh Valley Railroad Company, lessees of The Morris Canal and Banking Company, and of The West Milford Water Storage Company, The Montclair Water Company, and other Companies, and from the sources of the Passaic River and tributaries, and from Rockland and Orange Counties in the State of New York, all West of the Hudson River, a region adapted by nature to supply water in ample quantity and of unexceptionable quality; and the reservoirs of The West Milford Water Storage Company and of The Montclair Water Company are situated within convenient reach of New York, and at elevations sufficient to secure the requisite head pressure.

The above sources of supply are known to be ample to meet all of the requirements of the Cities of Northern New Jersey, and to leave a surplus applicable to your needs.

These waters will be conducted in pipes or in a permanently constructed aqueduct to the Jersey City shore of the Hudson River, under which, through a tunnel, the water will be conducted in suitable pipes of ample strength to secure absolute safety, guaranteeing a continuous flow of the waters required under a head pressure of at least 300 feet, delivered at such point on the west side of the lower part of the City of New York as your Honorable Board may determine, within three years from date of contract, at the price of seventy-five dollars per million gallons, payable quarter-yearly after delivery shall have commenced.

In this plan all inter-state questions are avoided, all riparian rights protected, and the waters from the sources mentioned will be in addition to the ample quantities provided for all the cities and towns of New Jersey dependent upon the Passaic water-shed for their supplies.

The acceptance by you of this proposition will secure to the City the following benefits and advantages:

1. It will enable you to obtain for the City the needed additional supply of water from an independent source, in less than one-half of the time it will take to get it from the Croton water-shed.

2. It will be delivered where most needed, in the lower part of the City, which is more exposed to danger, because more remote from the present sources of supply.

3. It will save to the city the cost of building additional mains from the reservoir in Central Park to the lower part of the City, which would be required by the Croton service.

4. The water will be pure and wholesome, and delivered under a head pressure of 300 feet, sufficient to force it to the tops of the highest buildings, and thus meet all requirements for every purpose.

5. It will enable the fire department to prevent large conflagrations, as the water, under pressure will be instantly available in masses to put out any fire that may occur, and thus provide the best fire service in the world, and at less expense than at present. This result cannot be obtained from the Croton service.

6. It will largely increase the revenues of the water department from sale of water for motive power, manufacturing and running elevators.

7. It will enable the City to have fountains in its public squares and public baths in abundance, and will enable the City to keep the streets and sewers clean, and thus improve the public health and lower the present death rate.

8. In the event of foreign war, military invasion, domestic violence or an accident to the present aqueduct, the supply we offer to deliver from an independent source far removed from the Croton basin would be of incalculable value.

The population in the upper portion of the City, and the annexed district beyond the Harlem River must, because of its location, receive its supply of water from the Croton water-shed. This population is increasing with great rapidity, and will require in the near future, all the water that can be secured from the Croton water-shed, drawing from the Central Park reservoir and from the new reservoir to be erected north of the Harlem.

The lower part of New York is being crowded more and more each year with an ever-increasing business.

Eight and ten-story buildings are being erected in place of the three and four-story buildings of thirty years ago, thus doubling the population and more than quadrupling the value of property within the same limits; but no provision whatever has been made for a sufficient supply of water under pressure in pipes of proper size and strength to meet these new conditions, that adequate protection to the great wealth and business of the lower part of the City may be secured.

I have the honor to present herewith to you documents which approve and ex-

plain our plans, and recommend a proper contract with the City, that the additional supply of water so much needed may be secured at the earliest possible day :

1. From the Board of Fire Underwriters and Fire Insurance Companies of this City.

2. From the Board of Managers of the Produce Exchange and petition from mercantile firms.

3. Report of Board of Engineers.

4. Legal opinions from eminent counsel on the laws relating to water supply to this City, and the powers of your Honorable Board to make a contract.

5. From the Military Authorities, letters of approval and indorsement from General Sheridan, General Schofield, and Major W. R. King, of the Committee on Fortifications and Military Defence, all approving our plans from a military point of view.

6. From the Medical Society of the County of New York.

7. From the Health Department of the City of New York.

When you indicate your readiness to accept this proposition on behalf of the City, a responsible corporation, under the laws of the State, with all powers necessary to perform the service required, will execute the contract in due form, and carry out in good faith its provisions.

I will promptly furnish you any further information required and satisfactory guarantees that myself and associates have the water required, the legal rights and financial strength to deliver the same to this City according to contract, and that we do not ask the City to become in any way responsible for our undertaking or pay us any money until after the water shall have been actually delivered.

Respectfully submitted,

J. R. BARTLETT.

FOR HIMSELF AND ASSOCIATES.

The above proposition to the City of New York is hereby approved by the undersigned corporations, who confirm the statements therein made as to the water supply at command of JOHN R. BARTLETT and his associates and assigns, from the sources specified, as represented by them respectively.

THE SOCIETY FOR ESTABLISHING USEFUL MANUFACTURES.

E. BOUDINOT COLT,

Governor.



ATTEST:

RICHARD ROSSITER,

Secretary.

THE LEHIGH VALLEY RAILROAD COMPANY.

By E. P. WILBER,
President.



ATTEST: JNO. R. FANSHAWE,
Secretary.

THE DUNDEE WATER POWER AND LAND COMPANY.

JOHN H. CHEEVER,
President.



ATTEST: EDMUND LE. B. GARDINER,
Secretary.

THE PASSAIC WATER COMPANY.

WILLIAM RYLE,
V. President.



ATTEST: JOHN C. RYLE,
Secretary.

THE ACQUACKANONK WATER COMPANY.

GARRET A. HOBART,
President.



ATTEST: E. T. BELL,
Secretary.

THE WEST MILFORD WATER STORAGE COMPANY.

HENRY C. ANDREWS,
President.



ATTEST: WM. P. ADAMS,
Secretary pro tem.

THE MONTCLAIR WATER COMPANY.

W. G. SNOW,
President.



ATTEST: ALBERT P. FISHER,
Secretary.

ADDRESS BEFORE THE
NEW YORK BOARD OF FIRE UNDERWRITERS,
ON THE SUBJECT OF WATER SUPPLY FOR THE CITY OF NEW YORK.
BY J. R. BARTLETT.
DELIVERED JUNE 22ND, 1887.

MR. HENRY H. HALL, President of the Board, called the meeting to order and made the following remarks:

Under the direction of the Board, I have invited Mr. BARTLETT to speak to us this morning, in reference to the present Water Supply of the City of New York, and upon the plans which he desires to suggest regarding its improvement. I have the pleasure of introducing to you Mr. JOHN R. BARTLETT, who will now address you.

Mr. BARTLETT then spoke as follows:

MR. PRESIDENT AND GENTLEMEN:—I thank you very much for your courteous invitation to address you on the important question of an additional water supply for this city, and to explain to you my plans for the prompt delivery of the same to meet existing wants. I will not attempt to make a formal speech, I am not here for that purpose, but simply to discuss and explain the facts touching the solution of this great question of water supply. I suppose that nearly all the gentlemen present are conversant with the facts, relating to the present Croton water supply. The city is now building a new aqueduct, and is spending a great many millions of dollars in its construction, which will be finished in about two years; but when completed we will have no more water than we have to-day, except during the storm months. After the Sodom dam is built we will have an increased supply, but nothing like the quantity required to meet the wants of the city. There will not be an adequate supply until after the Quaker Bridge dam is built, which has not yet been commenced. This dam will be a huge and experimental affair, being much larger than any other structure of its kind in the world; it will take a great many years to build, and is estimated to cost many millions of dollars. A large part of the Croton Valley will be depopulated by its over-flow, and the quality of the water, already bad, will not thereby be improved. The opposition to the building of this Quaker Bridge dam is very great, on account of the large additional cost and the uncertainty of the results. But even if the dam is constructed, and the quantity of water se

cured there by ample, still you must remember that it would not nor could not be delivered into this city at the elevation or pressure desired for fire purposes, or even for domestic use on the more elevated portions of the city.

I will now speak a few words about the various attempts that have been made the past few years to increase the water supply to this city, and remedy the evils from which the city is now suffering, and the liability to great conflagrations similar to those which occurred in Boston and Chicago. Chief among the attempts referred to was the one known as the Ramapo scheme in which it was proposed to take water from the Ramapo River in the Passaic water-shed, diverting the same from its natural channel, by carrying the water in pipes and conduits through cuts and tunnels through the intervening hills, to the west bank of the Hudson River, at some point near Piermont, opposite Dobb's Ferry; crossing the river in pipes laid on its bed, and down the east bank of the Hudson, entering the city at its extreme northern limit.

The Ramapo scheme failed to accomplish the desired results, for the simple reason that their plan was not feasible from an engineering point of view, because of the excessive cost and insecurity of the work, especially in conveying such a large body of water across the Hudson River through pipes laid on its bed. But if these engineering difficulties could have been overcome, they owned no water, and had no legal right to divert any from the natural channel of the Ramapo, or any of the tributaries of the Passaic River.

I now wish to call your attention to this map (see map) which I have had drawn to show the exact situation in regard to the water supply of the entire country within a radius of fifty miles from this city. Here you will see, at the right hand upper corner, the entire Croton water-shed drawn to a correct scale; and west of the Hudson River the entire Passaic water-shed, drawn to the same scale. In this way I am able to present to you the exact relative positions of the two sources of supply, and their relative capacities. The Croton water-shed, you will notice, is distant from this city more than thirty miles, having a drainage area, or water-shed, of about 360 square miles; while the Passaic water-shed is distant from this city only eighteen miles, with a drainage area or water-shed, of nearly 900 square miles. The Ramapo River, one of the tributaries of the Passaic takes its rise in Rockland and Orange Counties, in our State, but the waters of the whole water-shed which it drains, flow southward into the State of New Jersey, through their natural channels down to and joining the Pequannock River, together forming the Pompton River, which continues to flow southward until it joins the Passaic River at Two Bridges.

Now, gentlemen, I wish to take you with me across the river for a few moments, for the purpose of explaining the somewhat intricate questions of riparian or water rights, and that I may have the pleasure of laying before you more fully my plans which have led to the solution of the complex questions involved. You will please keep your eyes on this map while following me, for thereon you will see expressed the

physical facts from actual surveys, which are more eloquent to the eye than printed pages.

When my attention was first called to this question of water supply, it was to solve the difficult problems involved in providing for the necessities of the large and rapidly increasing population east of the Orange mountains; namely, Jersey City, Newark, Montclair and surrounding towns. I immediately applied myself to a close study of the reports, surveys and maps, that had been made on the subject during the past thirty years by commissions of the State, and the various boards of Newark and Jersey City. All attempts on the part of the cities and towns to secure for themselves the needed supply of pure water, which existed in ample quantities and finest quality near at hand, had resulted in constant failures. A study of the reasons "why" formed one of the important branches of my investigation; why had all these various attempts failed? The answer to that question is found in the multiplicity, so to speak, of municipalities, and only one water-shed. So it became evident to me early in my investigations that it would never be possible for several cities and towns to act in harmony in securing from one common source the desired boon. They could not all own the works, and none of them would consent to be tributary to the other, as their credits differed, as their populations varied, and as it was a physical impossibility to draw the line of demarcation between the various quantities that the different municipalities required; therefore the whole question became hopelessly involved. Then again the great cost of many millions of dollars necessary to purchase the water rights, and build the reservoirs and works, was too great to be borne by any one of the cities alone. Hence, nothing came of the various attempts in reaching out for pure water. All this time the water in use was growing worse, the pollution increasing as the population multiplied, until at the present time there are nearly 300,000 people using water for public and private use, pumped from a tidal stream, in which their own sewerage is dumped. It is therefore clear that the quality of the water supplied to the people from below the City of Paterson to the sea, including Newark and Jersey City, is unfit for use, a situation from which no help can come, except in a pure supply from the mountains above the Great Falls. I asked questions of various gentlemen who were most likely to be informed, and many others connected with the water service of the State, how to overcome the obstacles in the way; but none seemed to know; they all appeared to be helpless in proposing anything practicable to overcome the difficulties in obtaining a pure supply.

I then took up the matter and determined to reach a full knowledge of all the facts, to see if some practical business way could not be found to relieve the various cities and towns from the constantly increasing danger of the present impure water they are by circumstances compelled to use. Knowing it to be a great question, supplying these large communities with one of the necessities of life, it seemed to me an enterprise in every way worthy of my best energies and influence in seeking to overcome the obstacles, in the accomplishment of this great purpose.

I found that the first question to be investigated was that of riparian or water rights; I learned that the Society for Establishing Useful Manufactures, at Paterson, controlled the waters of the Passaic water-shed, and that their rights would have to be first secured by purchase or condemnation, and that other riparian owners, below the point or points of diversion, would have to be in like manner dealt with.

The nature, extent and value of the rights possessed by this ancient Society are interesting and important, and have been a subject of special study and investigation by me.

I retained eminent counsel having special knowledge of the subject to investigate, examine and report to me on the powers of this ancient Society, and regarding the riparian rights of the Passaic River, exerting controlling influence over the diversion of water for potable purposes. What were the rights of these people owning water powers? Did they control the waters of the Passaic water-shed? If they did, what were the facts? and the value of their rights? Could they be purchased or acquired? If so, how, and for what? These, you will see, were all vital and important questions, to which it was necessary for me to have exact and truthful answers, before I could even commence to lay the foundation for the great system I had in contemplation; namely, supplying the needs of the present and future generations of all the cities and towns east of the Orange Mountains in the Metropolitan District with one of the greatest blessings of life, pure water, which should be secured to them and theirs forever. Full reports from all these well known legal authorities were made to me in due time. They all agree on the main question and coincide on the main points, many quoting the same authorities and decisions that have given the sanction of adjudication, by the highest courts in the State, to the rights claimed by the Society. I cannot read all these reports now, as it will take too much time, and is not necessary. I will quote, however, in passing, from Ex-Chancellor Williamson's, who has a large and special knowledge of water rights in New Jersey. He says:

"The powers and provisions of their charter were ample and generous to effect the object contemplated, and to project and anticipate future developments on a scale of great magnitude. Its capital was four millions of dollars, with authority among other things, to purchase lands, tenements and hereditaments, to cut canals, to clean and improve the channels of the rivers, and to acquire the right and title to all streams and rivers in anticipation of the necessities for the full enjoyment of the object contemplated."

"It is a matter of settled judicial decision by the Courts of New Jersey, and so fully determined that it cannot now be questioned, that neither by legislative grant, or otherwise, can the waters of the Passaic River be diverted, except by the consent of the Society, unless by condemnation under the application of the doctrine of eminent domain."

"The ownership of the Society, by purchase or occupancy, acquired under and by the virtue of its charter, to the use of the whole of the waters of the Passaic at and above the

"Great Falls, is so well established by judicial authority, that it may be assumed with perfect security, that by any powers, acquired or to be acquired, of the cities of Jersey City or Newark, or other municipalities, or of any private water company, incorporated under the laws of the State of New Jersey, the waters of the Passaic above the Great Falls cannot be diverted without the consent of the Society, except by the exercise of the power of eminent domain."

Ex-GOVERNOR ABBETT says:

"They are the riparian proprietors, and upon plain and acknowledged common law principles they are entitled to the use of the stream. They have it in property growing out of the ownership of the soil, which is oftentimes of more value than the soil itself, and at all times as sacredly regarded by the law. This being the case, they have a right to enjoy it without diminution or alteration. This right, at all times valuable, is to the Society vital. Their hopes and expectations not only, but their very existence are dependent on it. The right is not confined to the use of so much water as may be necessary for their present purposes. They have appropriated to themselves the use of the stream. They have a right to take out the whole of it."

MR. WALTON:—I would like to ask, MR. BARTLETT, if all the gentlemen concur in that opinion?

MR. BARTLETT:—Yes, they all concur confirming the right of the ancient Society to use all the waters of the Passaic River and its tributaries, embracing the Ramapo, Wanaque, Pequannock, Rockaway, and all rivers and streams of the Passaic watershed flowing into the Passaic River, down to and over the Great Falls at the City of Paterson. Some quoted decisions and some did not, but they were all fully conclusive and absolute, that the Society's right to all the waters of the Passaic watershed as riparian owners is unquestioned, having had nearly 100 years uninterrupted use. This right has for ever been recognized by the English common law, and was regarded in the same manner, and held no less sacred by the Roman law two thousand years ago.

After the legal examinations were completed relating to riparian rights, and further exhaustive researches and reports on the water laws of the State were made, by many of the same lawyers, I began to see my way clear to the solution of the whole subject. Recognizing that the right to use water is property, and therefore to be respected and treated accordingly, I opened negotiations with the Society, at Paterson, to procure the exclusive control of the right to divert sufficient water from above the Great Falls, where it exists in its native purity, for the purposes required, namely, the supply of Newark, Jersey City and the surrounding towns. I saw that this was the real key to the situation, to unlock the door which would open to the communities on the river below, the much needed and long looked for supply of pure and wholesome water. I found that the Society had sold the

entire flow of the river at its minimum, or perhaps, more properly speaking, at its average flow, to the large number of manufacturers located on its several canals, under the form of perpetual leases. Consequently they could not lease or sell to me, or to any one else, the right to divert any of this water, and could only sell the right to divert the surplus, or superabundant waters of the Passaic water-shed, which during six or seven months of the year, called the flood months, flow over the dam of the Society, and the Falls, and away to the sea, in quantities sufficient to supply all the cities on the Atlantic sea-board every day in the year. This surplus water, not being utilized for manufacturing purposes, is, of course, now lost. You will remember we all were taught at school, that the greatest strength of a rope is equal only to the strength of its weakest part; therefore the flow of water in the Passaic River, at present utilized for manufacturing purposes, is equal only to the minimum flow during the summer months. Hence I found, that under the powers granted by the Society, and by the Dundee Water Power and Land Company, of the City of Passaic, (from whom like exclusive powers had to be secured,) such exclusive granted power would only give to me and my associates the right to divert the surplus waters. This would afford us plenty of water for all purposes during six months in the year, but would not provide for the remainder of the year. The consummation of these negotiations then led to this problem; the necessity of creating large storage reservoirs on the upper waters of the Passaic water-shed, to hold back said waters in flood time in such reservoirs, to be let down in the natural channels of the rivers during the dry season, or season of least flow. The waters so stored being the property of myself and associates, would be taken out of their accustomed channel at such point or points above the Great Falls as our engineers might select as most convenient and compatible with the greatest purity and excellence of the waters, and the least cost of delivery to the distributing reservoirs below. In this way we would procure an ample supply of the finest water in the world for delivery on every day in the year, and all the mill owners along the river would have during the dry seasons, more water than they ever had before.

My negotiations with the Society were successfully closed, thus securing to ourselves their entire, exclusive and legal control of all the surplus waters forever. A like exclusive contract, with varying conditions to conform to the facts, was likewise secured and duly executed with the Dundee Water Power and Land Company. When all this had been accomplished, I was then ready to proceed with the selection and purchase of reservoirs.

During the months of time which it took to make these examinations, and carry on the negotiations to secure the necessary water rights, I had in my employ the best hydraulic engineers I could find, to audit, so to speak, the reports made by the various engineers in the past, who had studied the same subject, after which I had re-surveys and re-examinations, and fresh reports made for my own personal use. Under the advice of my engineers, and in harmony with the reports and surveys that had been previously made, covering the entire Passaic water-shed, I decided that it was necessary to purchase, quietly,

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MACOPIN LAKE (Echo.)

Elevation above sea level about 900 feet. Its water is 50 to 60 feet deep, sandy bottom and rocky shores; its outlet flows into the Pequannock River, tributary to the Passaic.

sufficient reservoir capacity to hold an adequate supply for every day in the year. When this point was reached it became a question of pluck and money.

It was at this stage of my plans that it became necessary to have undoubted financial strength, and the use of large sums of money. I then presented the enterprise with all the facts I had gathered together, to a number of gentlemen in this city, whom you all know, having the necessary enterprise, public spirit and abundant capital, I explained the good results that would surely follow the construction of a great system of water supply for the cities of North Eastern New Jersey as well as New York City, if built on a sound and enduring basis. I told them what I am now telling you. We went over all the facts together. The response was firm and business-like, and the necessary capital, promptly pledged. I then proceeded more actively in carrying out my plans, in the purchase of lands and lakes for reservoirs.

I wish to point out to you on the map here, Lake Macopin. A large part of this lake was among my earlier purchases. It is a beautiful lake, land locked among the hills, about two miles in length, half a mile in width, fifty to sixty feet deep, free from all source of pollution, with a sandy bottom, clean shores, no vegetable decomposition present or possible in its waters, and has an elevation above tide-water of 1000 feet, with a large water-shed of its own, which makes this lake of great value as a storage reservoir; it is only forty miles distant from this city, with a daily output of about nine million gallons of the purest water that nature affords, which can be largely increased during the season of the year when most needed.

The next point which claimed attention was Dunker Pond, (so called). You will find it located here (pointing on the map); like Lake Macopin, it is tributary to the Pequannock River. Here, as elsewhere, I availed myself of the various reports and surveys which had been made many years before. I found that Dunker Pond embraced in water surface only about 25 acres, which was located at the south-western end of a level plain nearly four miles in extent, surrounded by high hills, generally wooded, with a large drainage area tributary to it. The output from this lake, running through a break or gorge in the granite hills, which had been rent asunder in some past age, amounted to millions of gallons daily of the purest water. While availing myself of previous reports on the value of this locality for storing water, I also sent my own engineers there, and had the whole country around it thoroughly examined and surveyed. The reports made to me on the capacity of this remarkable reservoir site, showed that a dam, forty feet high, built at the southern end of the valley across the gorge referred to, would make a reservoir four miles in length, from one-half to three-quarters of a mile in width, of irregular shape, and containing forty feet of water, with an outflow of over sixteen million gallons daily. There were at least forty owners of lands here to deal with, and fully six months time was expended by my representatives in purchasing this property, examining the titles, etc., all of which has been accomplished, the deeds taken and

paid for, and this large and valuable site added to my system for gathering water for the use of the populations I have referred to.

You are doubtless aware that the value of a reservoir to be drawn on for potable purposes, consists first in the amount of water it will hold, and second in the extent of its drainage area; that is, the extent of the rain-fall which it collects during the storm months so that it will always be full to yield its store of water when drawn on during the season of least flow.

After the purchase of Dunker Pond was completed, we secured by purchase and lease the full control of Split Rock Lake, containing already about 250 acres of pure water 10 to 20 feet deep; like the previous lakes purchased, having no habitations whatever around its shores, remaining almost in a state of nature, with a large water-shed of its own, composed principally of rough mountain land with no cause or source of pollution existing anywhere within its water-shed.

We have since then purchased, and have taken title in fee to the famous Montville reservoir, tributary to the Rockaway River, which is also of large capacity and great value to the system. We have also purchased large storage reservoir sites in other localities, namely, Kaikout reservoir, with a large water-shed of its own, and having a daily output of the purest water of about twelve million gallons daily, running into and tributary to the Pequannock River and Mecanesi reservoir, with a large storage capacity, likewise tributary to the Pequannock system.

These are matters of detail, suffice it to say that much additional storage property has been purchased in other parts of the Passaic water-shed, enough to furnish a storage capacity for an output, including the Ramapo system, exceeding one hundred million gallons daily.

All of these reservoirs I have referred to, are gathering or feeding reservoirs, to be used for holding back waters in flood time, to be let down in time of drought, or during the season of least flow. All of this you will see is necessary, in the very nature of things, to solve the great question under consideration; yet, after the purchase of these properties, it followed as a natural result that distributing reservoirs of large capacity, befitting so large a system, should be at once secured, in order to make it complete. Such distributing reservoirs were known to exist; nature had carved out and formed them, and located one on the top of Garret Mountain, near the City of Paterson, on the northern spur of the Orange Mountains. There a great bowl or hollow space had been scooped out, nearly 300 acres in extent. By building a dam at its southern limit, water could there be held, having a depth of forty feet, with an elevation of over 400 feet above tide-water, and distant from New York City only about fifteen miles, or about the same distance that Riverdale, the northern limit of the city, is from the lower part of New York.



LAKE MECANESI.

Its waters flows into the Wanaque River, tributary to the Passaic.

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South of Garret Mountain reservoir, and contiguous to it, lies the Great Notch, affording another natural location for a second distributing reservoir, with an elevation above tide-water of about 300 feet. After consultation with our engineers and counsel, we purchased both these reservoirs, to be added to the system, to act as distributing high service reservoirs for Montclair, Newark, Jersey City and surrounding towns. The larger and higher reservoir, known as Garret Mountain reservoir, will afford an ample head to deliver water into the City of New York at a pressure of three hundred feet, if desired.

So, the rest of the work simply becomes a question of laying suitable pipe from the Garret Mountain reservoir, distant 14 to 15 miles from this city, and the water will run from there by gravity to any designated point in New York City where it may be needed. Therefore the waters from the Ramapo, Wanaque and Pequannock rivers, pure sources all of them, will be allowed to run down their natural channels, through and over the courses appointed by nature for them to run in, on their way doing their appointed work, satisfying and meeting the demands of all parties having riparian rights; said waters will be taken at such point or points below where they join together and enter the Passaic River, by gravity or pumping, or both, as may be best, to the Garret Mountain and Great Notch reservoirs, and from these distributed as required. The water for New York will come direct to the Jersey City shore of the Hudson River. In this way all interstate questions are avoided, the requirements of all riparian owners are fully met, no one having any cause for complaint, as the water runs through its natural channels. The exclusive legal rights to divert the same at the points required above the Great Falls, having been secured to myself and associates forever, the solution of the question is reached. The waters of the Ramapo will be carried from the storage or distributing reservoir, to the Jersey City shore of the Hudson River; the New York water company will run its pipes across the river and take the water from there, and conduct it into the city.

The remaining question now, gentlemen, that interests you and me, is, how to cross the Hudson. How are these fifty or sixty million gallons of water which I propose to deliver to this city, to be taken with safety over, or under, or through the seemingly insurmountable obstacle to their delivery, namely, the Hudson River? The plan of laying pipes across the river for this purpose has been talked of, and reported on by various engineers for several years. I took the matter up personally about nine months ago to satisfy myself as to how with safety the Hudson River could be crossed. I consulted with many engineers; some said lay flexible pipes, others said, that could not safely be done in sixty feet of water, with a four mile current, and mud at the bottom several feet deep. Certainly it can be done; the doing is only a question of money. But who would be willing to pay such bills and guarantee a continual flow through such pipes thereafter? No one. I went into this subject of pipe laying thoroughly, and will dispose of it very quickly by stating, that after getting full reports on the subject, made by competent hydraulic engineers, in whom I had full confidence, I dismissed that way

of accomplishing the object as utterly impracticable, and not for a moment to be considered with either rigid or flexible joints.

So I abandoned all idea of a pipe line on the bed of the river, where, if laid, it could not be examined to repair a leak, as it could not be reached, and thus the whole system would be disabled and have to be relaid, during which time the city would be without water.

The next subject in my work of investigation, in order to perfect the system, was to build a tunnel to put our pipes in. While I was immersed in these estimates and plans, how to solve this question, the directors of the old Hudson River tunnel, which was commenced some 13 years ago, on which construction had been stopped for want of funds, came to me to financier for them; to furnish them with money to go on with the work, and to interest me with them in its construction. It seemed to me that the tunnel was what I wanted in which to lay our pipes, to deliver water into the lower part of the city. I set my representatives promptly at work to investigate all the legal facts and history of the tunnel, and my engineers were directed to examine into its physical condition. I had its walls cut into in various places to determine its solidity; I found it to be as strong and solid as if built in rock. I was astonished at the condition of things I met with in this investigation; it was much more satisfactory than I had any reason to expect. The process of boring the tunnel was next considered. Some time was consumed in the initial investigations; the water had to be pumped out, the air locks examined and put in order, expert men secured familiar with such work, all of which, however, has been done, and at the present time I have about 200 men at work under the Hudson River, some sixteen hundred feet from the Jersey shore, building new tunnel at the rate of about three feet per day. The question of whether the tunnel can be built according to the plans adopted I consider forever settled. The speculative and unknown quantities have been almost entirely eliminated from the enterprise, as far as physical or engineering difficulties are concerned. There are no "ifs" about it. The tunnel is a substantial fact, it can be built. The doubts and uncertainties connected with it as an enterprise at its commencement, have been removed by actual demonstration in the progress of the work, proving that all engineering difficulties have been overcome. You will observe on this map here the present condition of the work (pointing to map) which I am now building at the rate of speed that demonstrates it can be completed from shore to shore in twelve months.

Question:—Does the clear space on the map there represent the amount of tunnel actually built?

Mr. BARTLETT:—Yes, the clear space on the map represents the interior or finished portion of the tunnel, between the red lines, which represent the shell.

The greatest difficulties that have been met in the construction of the tunnel were on the New York shore, where they were thought to be insurmountable; but the indomitable energy and abiding faith of Mr. Haskin, the contractor, in his ability to overcome all

obstacles, conquered, and the obstacles referred to, namely, quicksand and mud, were overcome and were made submissive to the great work, which proceeded until they were passed, and the tunnel securely bricked up as solid as this building, to the extent of over 300 feet on the New York shore. The work at present is proceeding from the New Jersey shore. The tunnel is lighted with electric lights, and is as solid and safe as if built through solid rock.

My object in interesting myself in this tunnel was, not to complete it to accommodate the railroads, or the great traffic of this city, but to place therein pipes of size and strength sufficient to deliver an adequate water supply to the City of New York; it comes in at the right moment as the intervening link, to complete the system, affording a safe and reliable conduit or way, in which one or more steel pipes of ample strength can be safely and securely laid for all time. This North tunnel, affording the avenue for water conduits, can be finished in less than twelve months.

Question:—Do you propose to build on the present plans, which are intended for a railroad tunnel?

MR. BARTLETT:—Yes, the present plans, in the construction of the tunnel, will be carried out; as there are 2000 feet of tunnel having capacity for a train of Pullman palace cars to go through with ease, comfort and safety, both tunnels will, of course, be completed in accordance with the original plans. My object being, however, to put steel pipes through the bottom, where there will be ample accommodations for water and also afford facilities for telegraph and telephone wires. As at present planned there are two tunnels parallel to each other, circular in form, each with an iron shell, or casing, and thirty inches of brick and cement around the interior circumference inside of the iron shell, which insures massive strength and the form adopted renders it indestructible, as there is no weight which could possibly be brought to bear that would affect it in the least degree. In fact, like an arch, the greater the pressure from the outside upon it, the greater the strength of resistance. As I have stated, water pipes can be carried through this tunnel, or an independent tunnel of smaller diameter to be used exclusively for water pipes and purposes other than traffic, if desirable, and can be done quickly. The pressure of three hundred feet head will, of course, be too great for the system of pipes now laid in the streets of this city, but you need that pressure for fire purposes.

The Commissioners of the Sinking Fund of this city have power by law to create an independent system of pipes, for fire service exclusively, that will have sufficient strength to stand the pressure of three hundred feet head, which would secure to the fire department absolute control over every fire possible to occur. This pressure can be reduced to forty or fifty pounds to the square inch without difficulty or much expense, and the water used in the present system of pipes now laid in the city for domestic purposes, which would give to New York the best service of any large city in the

world. A further advantage would be that any desirable head or pressure could be obtained in any part of the city, sufficient to meet any emergency or requirement.

So in the fullness of time all these things have come about, which renders possible the furnishing to this city of an adequate supply of the finest quality of water.

The legal questions are completely met, all physical difficulties are in like manner overcome, and the water desired can now be delivered into this city at a much less price than the city can procure such a supply for itself; and furthermore, the water will be delivered at the lower or southern end of the city, where it is required with a pressure. This service will in itself be an independent supply, so that dependence will not as now be based wholly on one source for an article of universal consumption so essential to the safety and health and prosperity of this city.

MR. KIRBY:—Before you close, Mr. BARTLETT, it may be interesting to some of the gentlemen from New Jersey present, who would like to know what kind of water they are now drinking, to have you explain these maps showing the condition of the river below the City of Paterson.

MR. BARTLETT:—The City of Paterson at present has an estimated population of about 70,000, which is rapidly increasing. The sewerage of the entire city runs into the Passaic River below the Falls. That blue tint on the map represents water as it comes down from the mountainous section of the Passaic water-shed in its native purity. At the City of Paterson the water in the Passaic River falls a distance of sixty-six feet at the point known as the Great Falls. The water below these Falls becomes polluted from the discharge of the sewerage of the city, and the filth and pollution from the manufacturing establishments along the banks of the river. From that point, all the way down the river, past the City of Passaic, and onward the river becomes a natural sewer. There are two cemeteries through which water percolates and drains into the River. The red lines on this map indicate sewers, which, including those of the City of Newark, you will notice pour their contents into the river all along its banks to the Newark Bay, and which the improvements, so called, for the navigation of the lower Passaic, carried on by the United States Government removing rocks, etc., allows the tide to back up more freely of late years than ever before; the result of which is that the tide carries with it the sewerage of the City of Newark past the pumping works of Jersey City, and even beyond the pumping works of Newark itself. So that, as a matter of fact, Newark pumps some of its own sewerage into its water mains, which distributes the same into the houses throughout the city. The same applies in a greater extent to Jersey City, because the intake of Jersey City's pumping works is below that of Newark's. Consequently, Jersey City gets a greater dose of Newark's sewerage than Newark itself. The dark green on the map referred to represents salt water and sewerage combined. Jersey City therefore gets salt water mixed with sewerage, but it appears that Newark gets sewerage with a less percentage of salt water.

I think, gentlemen, I have occupied your attention long enough. I hope I have made myself sufficiently clear, and interested you in this great subject. I shall be happy to answer any further questions or give any further explanations of my plans in detail in the carrying out of the propositions suggested to supply New York City with the water so much needed.

MR. EDWARD A. WALTON (President Citizen's Fire Insurance Co.)

MR. PRESIDENT:—If any justification were needed for the invitation extended to Mr. Bartlett, at your suggestion, by the New York Board of Fire Underwriters, to appear before them, I think, Mr. Bartlett has fully justified your suggestion by the statements he has made so clearly and fully, and if any apology were needed from those of us who have asked your committee on water supply to indorse this matter, I feel that Mr. Bartlett has offered as ample an apology as any one can make.

What we are interested in is, not what these gentlemen will charge the city of New York for the water they control and propose to use, but the great point is that we want water, and when we need it for fire purposes, we want it quick; and that is the thing that we want to impress upon the authorities of this city. I was not aware that this meeting was to take place until about 10 o'clock this morning, and have made no preparation to speak on the subject. I am somewhat familiar with this subject, and the territory, and I know that he does not exaggerate at all the flow of water in the Passaic water-shed. I am not clear on one point, but I believe I am not wrong when I state that the volume of water of that water-shed is greater than that in the Croton water-shed.

MR. BARTLETT:—It is about three times larger; it has about 900 square miles.

MR. WALTON:—Mr. Bartlett has shown us that there is a great natural reservoir less than fifteen miles from the City Hall. He has proposed a plan of getting the Passaic and Ramapo waters to this city, and we have learned that it is a practicable scheme; so I do not think that the Water Committee or the Board has any cause to regret its action of last week in indorsing the plan now so fully explained by Mr. Bartlett.

Since our last meeting, I have learned two points from a very prominent official connected with the Aqueduct Board of this city. That gentleman, whose name I do not care to mention, although his statement was not made in confidence, but who is a man whom you all know by reputation, and a man well acquainted with the water needs of this city and the surrounding country, has stated to me positively, and that is the point which we wish to emphasize, that it is utterly impossible for the water supply of this city to be materially increased under a period of four or five years. He states just exactly what Mr. Bartlett has stated; that this new aqueduct when completed will only slightly increase the city's supply of water.

Now, this gentleman says that the Commissioners have really taken no active steps to add to the supply of water, and it would be utterly impossible to add any material volume to the water coming through the aqueduct for at least four or five years. That is a very

important point for us to consider. In that connection, I asked him if he had any knowledge of this plan. He said that he was somewhat familiar with it. I asked him what would be the effect of so great a pressure of water, 300 to 400 feet head, on the existing plumbing of this city. Well, he said, of course that force would be naturally too much for the pipes, but that is a mere matter of engineering, and it is a very simple matter to apply reducers, so that the pressure can be toned down to meet the emergency.

MR. JOHN H. WASHBURN (Vice-President and Secretary Home Insurance Company.)

Mr. President: The Water Committee were impressed, as you can very easily imagine, by Mr. Bartlett's statement to them, and felt that if the facts were put before us as Mr. Bartlett has done, it was due to ourselves, and due to the Board, and the interest that we represent, that they should be brought before the Board; and we believe that the prestige and influence of the Board should be used to induce the Sinking Fund Commissioners to do something to accept Mr. Bartlett's plan, and the committee was prepared to indorse the plan, and after what Mr. Bartlett has said to-day we are certainly more impressed.

MR. HENRY A. OAKLEY (President Howard Insurance Company).

I am very much impressed with this statement which is made to us to-day, and more so, as I was interested in the original Ramapo scheme, for which I took a great deal of pains to make a statement before the Sinking Fund years ago. But there is one thing in regard to the amount of water from the Croton water-shed to consider; we have a great city which is increasing beyond that of any other city except London, and the water that is to be secured by the new aqueduct is not going to be sufficient to supply the needs of this city for the next forty or fifty years; but it seems to be overlooked by those who take into account the matter of the building of the new aqueduct that it is merely a supplemental aqueduct to the one we have at present, which is found to be so defective that it has created great anxiety for fear that it would give way and the city left without water at all. I think, as Mr. Walton has expressed it, that the new aqueduct will not deliver any new pressure to this city for many years to come, until, as Mr. Bartlett says, the great Quaker Dam is completed, which no doubt would increase the supply. But here we have a supplemental supply, which is going to make this city free from great conflagrations, and at the same time is going to supply it with water that is unquestionably pure; and if we look at it from a sanitary point of view, which every man should as a citizen and not as an underwriter, we should want to adopt and carry it into effect.

MR. ABRAM M. KIRBY (Secretary L. D. Continental Insurance Company).

Mr. Walton has already shown that the Committee on Water Supply need not offer any apology for bringing the members of the Board to this meeting, but, on the contrary, the thanks of the Committee are due, and I move that they be extended to Mr. Bartlett, for his comprehensive, interesting and instructive address.

The motion was seconded and carried unanimously.

PLAN FOR DELIVERING
UNDER THE HUDSON RIVER 50,000,000 GALLONS OF WATER DAILY
TO THE LOWER PART OF THE CITY OF NEW YORK.

No. 2 WALL STREET,
NEW YORK, November, 1888.

The problem of conveying with safety, fifty or sixty million gallons daily of water across the Hudson River, was one of the first and most difficult questions that engaged my attention, (knowing that steadiness in the delivery, without intermission for a single day, is the first requisite in any system of water supply to a great city,) which must first be determined before we could propose to deliver the needed supply of fresh water under pressure into the lower part of the city, from a source independent of the Croton watershed.

SYSTEM OF PIPE LINES LAID ON BED OF RIVER.

It had been proposed to me that a system of pipes with flexible or rigid joints could be laid in a trench on the bed of the river that would meet the requirements of the case, but, after making a thorough personal investigation of the subject, and analyzing the reports of competent engineers whom I called to my aid, the delivery of 50,000,000 gallons or more of water into the lower part of the City of New York, by any system of pipes laid on the bed of the river was deemed unsafe and utterly impracticable, for the reason that the Hudson River, opposite New York, is about one mile in width with a four mile current running twice daily, because of the ebb and flow of the tide, and its waters in places 60 feet in depth, with several feet of soft mud or sediment at the bottom. A 36 inch pipe is stated to be the largest diameter with flexible joints yet laid. It would require not less than six such pipes to carry 50,000,000 gallons daily into a reservoir and more than that number to supply that quantity directly to the distribution pipes, without undue loss of head in either case. To guard against accidents or failure of a single line of pipe, there would have to be still more of them, and they would have to be laid on widely separated lines, spread out like a fan on the bed of the river. Besides, we would have to keep a pipe laying plant constantly in readiness at great expense to relay broken lines. Vessels sometimes of large size and weight sink in the river, and anchors and other heavy substances are continually dropped or lost overboard, any one of which falling on such pipes would break them, even if laid in an ordinary trench dug in the bed of the river, which would be a most difficult and expensive operation in such depth of water and strong current. The pipes could not be laid on the surface of the mud because in sinking into it they would pull apart with their own weight. Thirty-six inch pipes have been successfully laid in other cities, but nowhere under the conditions existing in the Hudson River. Another important factor entering into the problem is, that the pressure of contained water, while it constitutes a simple problem, in the case of a rigid pipe, becomes a serious difficulty in case of a flexible pipe. All such pipes leak more or less, and in the case under

consideration, viz: 400 feet net head likely to be on such pipes, any leak under these circumstances occurring would rapidly increase in size of vent and amount wasted, with no way of ascertaining where the leak was, the pipes being buried in water without the means of getting at them for repairs. In this manner the whole system might speedily be disabled. Therefore on the ground of economy, reliability and durability, all idea of a system of pipes across the river was abandoned.

The very obstacles mentioned to a line of pipes on the bed of the river suggested a tunnel under the bed of the river in which steel pipes of ample strength could be safely laid and protected from all accidents, easily get-at-able to repair any leak if it should ever occur, and in this way only a continuous flow of water into the city without interruption could be guaranteed to the contracting parties.

HUDSON RIVER TUNNEL.

The building of a tunnel under the bed of the river in which to lay water pipes was then carefully considered; doubts were expressed even among engineers as to whether a tunnel could be built through the silt existing to an unknown depth. It became necessary to remove all doubts and to ascertain not only that a tunnel could be built, but how long it would take to build it and what it would cost. These were important factors that must first be ascertained, to secure sufficient data on which to base a proposition. The only reliable way to settle such doubts was to actually build a tunnel in whole or in part, sufficient to ascertain the real facts, with this purpose in view I interested myself in the present railroad tunnel already partially built under the Hudson River, on which work had ceased for lack of funds, to investigate its physical condition and if necessary to make a demonstration sufficient to prove

1. That the tunnel through the silt in the bed of the river could or could not be built, and

2. To ascertain the cost and practical working of the present method employed, of boring through the silt by the aid of compressed air.

I furnished Col. D. C. Haskin, the promoter and contractor of the present Hudson Tunnel Railway Co., and the inventor of the system of using compressed air employed in the construction of the tunnel, with the necessary capital to make a thorough examination and revive the work that had been stopped for want of funds. The water was pumped out and a careful and rigid investigation was made into the physical condition of the tunnel. I found it to be of massive strength and great solidity. The old air locks were then cleaned out, machinery put in order, air compressors started, electric light plants set up, material purchased and about 150 men employed, divided into three gangs, 50 men each, working 8 hours, were set to work in the heading to construct new tunnel, working night and day; deeming this the only practicable and sure way to determine whether the tunnel could be built and answer all doubtful questions.

The North Tunnel at that time was built out from the Jersey shore a distance of about 1,550 feet. At this point, about 80 feet below the surface of the water, the work of

construction commenced, the excavation of silt, putting up the massive steel plates or outer shell, as represented in plates Nos. 2 and 8, and filling in the brickwork 30 inches thick inside of the shell as shown in figure No. 7.

These drawings and illustrations of the tunnel herewith are made from the actual workings of the present tunnel during construction.

The air pressure in the heading necessary to resist the pressure from without or from above was found to be 32 pounds to the square inch, in which the men worked with ease and safety. The silt held the air perfectly and would hold it for several hours, with little apparent diminution after the air pumps were stopped. Thirty-two pounds was found to be the equivalent or balance of the inward pressure at high tide; at low tide with six feet less water on the Hudson River overhead, a difference of two pounds was noticed in the gauge. The work proceeded at the rate of about three feet per day of finished tunnel, which was kept up without intermission for a period of about one hundred days until over three-hundred feet of new tunnel, perfect in all its parts, strong and substantial, had actually been constructed, nearly in the centre of the river with about thirty feet of silt above the crown of the arch, and forty feet of water on top of the silt. All of this work was accomplished without any trouble, accident or drawbacks of any name or nature. This result was gratifying and satisfactory, proving beyond all doubt that a strong, permanent and safe tunnel can easily be built through the silt under the bed of the Hudson River. It also proved that if I continued the work at the same rate of speed working from both ends, the tunnel could be completed from shore to shore in about twelve months. It also established a standard, or furnished reliable data by which the cost of the whole completed tunnel as a conduit for water pipes only could be ascertained.

QUALITY OF THE DEPOSIT IN THE BED OF THE HUDSON RIVER.

I had been informed that the silt in the bottom of the Hudson River would not hold the air under pressure sufficient to resist the weight of the silt and water above; that the air would escape and the workings of any tunnel, if attempted, would be flooded or collapse altogether. This in practice is not so. The deposit in the bed of the Hudson River is composed of the detritus from the rocky formations of its watershed, worn and washed by the storms of ages, and brought down by the flow of the streams and deposited in the bed of the river at its mouth, forming a more compact and dense mass than elsewhere exists, for the reason that the ebb and flow of the tide in the lower Hudson causes daily periods of stagnation of its waters and consequent vertical deposits of the heavier and finer particles of silt which have filled in the spaces and interstices in the bottom of the lower Hudson, caused by the upheaval and depression of the strata creating the Palisades and the cavities and dip of the submerged portion to unknown depths, which the river has in its downward flow to the sea filled up and smoothed over with the deposit to its present depth.

The result is a fine, compact, solid bed of rocky detritus, as immovable as the rocks which underlie and surround it. It is much safer in some respects for tunnel building

than ordinary rock, for the reason that its composition is uniform and free from seams or fissures and the percolation of water. It will remain where it has been deposited a fixed mass for all eternity. Its weight exceeds 109 pounds per cubic foot with a specific gravity equivalent to 1.75, or nearly the same weight as brick, mortar or clay. This fact proves the fallacy of the absurd statements that have been made, that the bed of the river is shifting or moving; on the contrary no force can move it, it is immovable as the continent.

INSPECTION OF THE TUNNEL DURING CONSTRUCTION BY THE COMMITTEE OF THE N. Y.
BOARD OF FIRE UNDERWRITERS, ENGINEERS AND OTHERS.

A Committee from the New York Board of Fire Underwriters, Engineers and others, visited the tunnel to make a personal inspection of the workings, to satisfy themselves that the tunnel was not a fiction, that the successful construction of it was actually in progress, and that they could see it with their mortal eyes. They went through the air locks into the heading under the river and saw the work of construction in progress and satisfied themselves that the building of the Hudson River Tunnel was an accomplished fact.

The work of further construction, after these facts were ascertained, was no longer necessary until after a contract with New York was secured, requiring the delivery of water; as I was not interested in building the tunnel for railroad transportation of passengers and freight, my object being wholly to remove every obstacle in the way of the delivery of an abundant supply of water to this City. The work I did to prove the facts stated can be continued until the New York shore is reached, and said tunnel be used as a conduit for water only. This would save the expense of building railroad terminals. If the present Hudson Tunnel Railway Company complete the work they have commenced for the purposes originally contemplated, the running of railroad trains for transportation of passengers and freight, in such case two water pipes 42 inches in diameter each, made of steel of ample strength, can be laid in the bottom of said tunnel as represented in sectional drawing No. 4; but if it should be deemed unwise for any reason to put water pipes in a tunnel through which heavy railroad trains are passing, we would build a tunnel of smaller diameter for water purposes only, in which case one pipe six feet in diameter or larger would be put in said tunnel, as represented on sectional drawing No. 3. Such tunnel can be built in less time than the present large one can be completed, working from both ends at the same time, at the same rate of speed, which I easily accomplished in the work already done. The construction of the smaller tunnel would not take over twelve months. In this manner the passage of the Hudson River by a large system of conduits is no longer a doubtful question. The present tunnel can be completed for water purposes only, if its present owners do not complete it for railroad purposes; or we will build a smaller tunnel, all at our own risk, whenever the City of New York makes a contract with myself and associates to deliver to it a plentiful supply of pure water, from a source independent of the Croton water-shed.

J. R. BARTLETT.



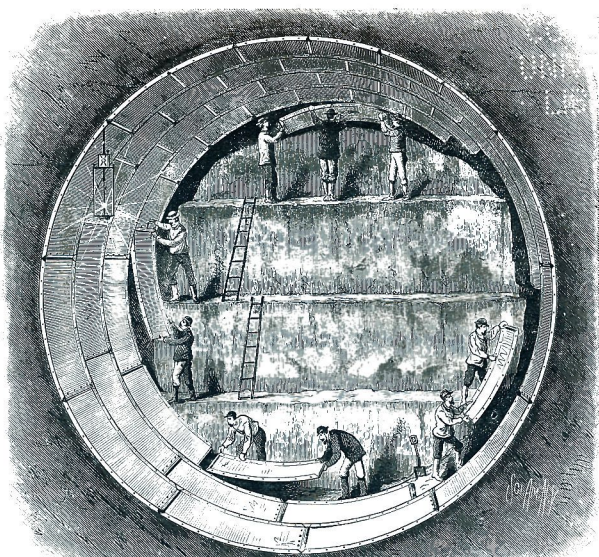
WIDTH OF THE HUDSON RIVER BETWEEN NEW YORK CITY AND JERSEY CITY, FROM BULKHEAD
TO BULKHEAD ON LINE OF TUNNEL

LENGTH OF NORTH TUNNEL FINISHED FROM JERSEY CITY SHORE.....
NEW YORK SHORE.....

LENGTH OF SOUTH TUNNEL FINISHED FROM JERSEY CITY SHORE.....

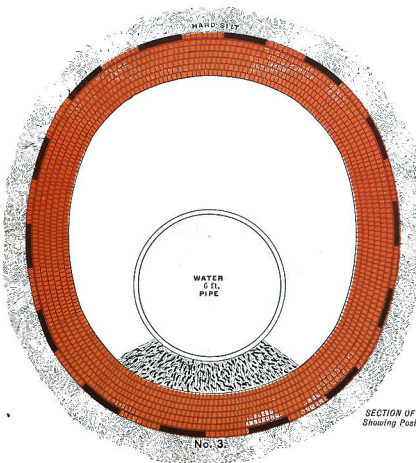
THE TUNNEL IS ELLIPTICAL IN FORM. OUTSIDE DIAMETER, 23½ FEET HIGH; 21½ FEET WIDE;
INSIDE DIAMETER IN THE CLEAR, 18½ FEET HIGH; 16½ FEET WIDE.

5600 FEET.
1800 "
300 "
500 "

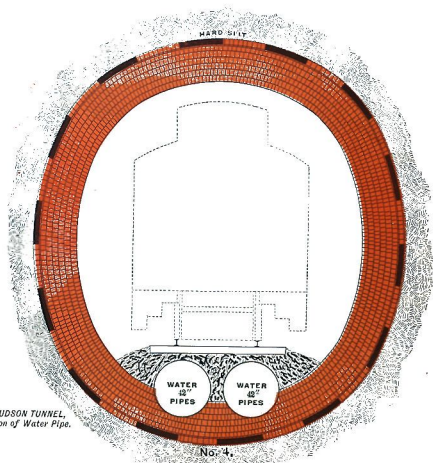


AT THE HEADING

ADVANCING THE IRON TUNNEL PLATES



No. 3.



No. 4.

SECTION OF HUDSON TUNNEL,
Showing Position of Water Pipe.

ASBULLO
TRESVARI
VIAVARI

PROFILE OF THE HUDSON RIVER TUNNEL WITH WATER CONDUIT.

Showing depth of river and contour line of the deposit of soft and hard silt at the bottom, with approximate depth of the same as determined by soundings.

JERSEY CITY

NEW YORK

Shaft

Bulkhead Wall

Wentz St.

Datum Mean Low Water 500'

1000'

1500'

2000'

2500'

3000'

3500'

4000'

4500'

5000'

Datum Mean Low Water

LINE OF SOFT SILT

LINE OF TENACIOUS SILT

LINE OF VERY HARD SILT

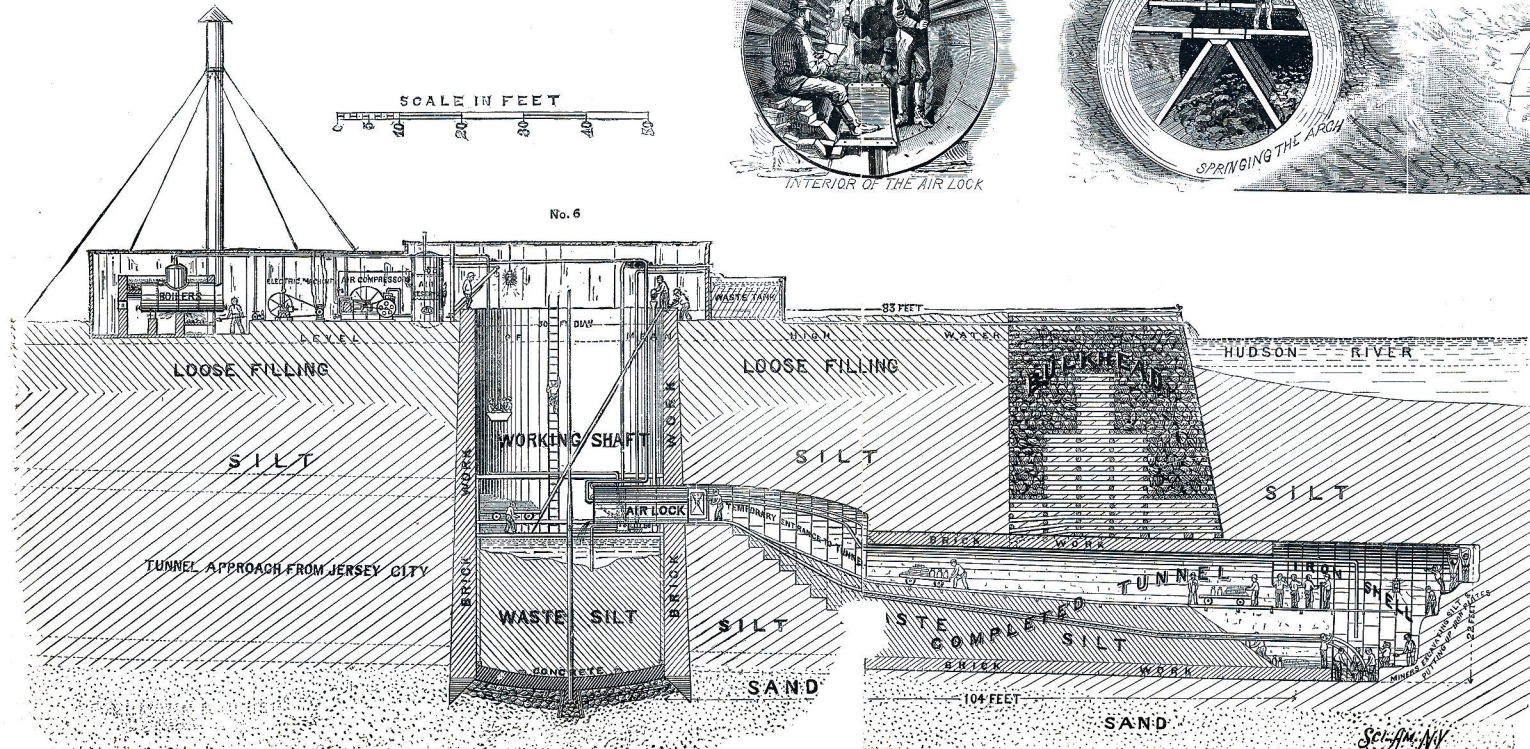
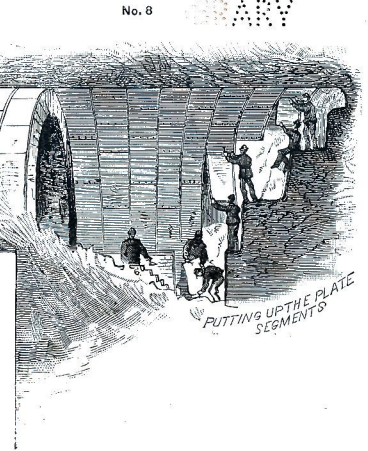
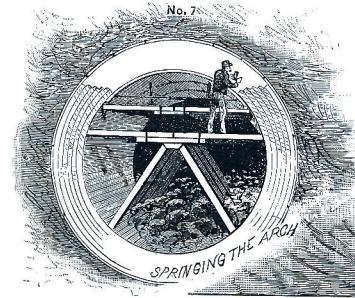
WATER PIPE

GRADE 0.82 per 100'

ROCK

SAND

Grate 2.68 per 100'



PETITIONS
TO THE
COMMISSIONERS OF THE SINKING FUND.
FROM THE
COMMITTEE ON WATER SUPPLY OF THE NEW YORK BOARD OF FIRE UNDERWRITERS,
ALSO FROM
MERCHANTS, CITIZENS AND OTHERS.

NEW YORK BOARD OF FIRE UNDERWRITERS.

Room 37,

BOREEL BUILDING,

No. 115 BROADWAY.

To the Commissioners of the Sinking Fund of the City of New York:

GENTLEMEN:

At a meeting of the Board, held on the 15th of June last, the following preamble and resolution was adopted:

“Whereas, the plans presented by Mr. John R. Bartlett, for the delivery of a large
“and permanent supply of potable water under pressure of three hundred feet head, if
“desired, available at all times, for the extinguishment of fires, and for domestic and pub-
“lic uses in the City of New York, having had the careful consideration of the Commit-
“tee on Water Supply of this Board; and

“Whereas, the said Committee having reported to this Board that in their judgment
“the plan presented by Mr. Bartlett is feasible, and if adopted will be of great benefit and
“value to this City, is entitled to the support and inforcement of the Underwriters of the
“City of New York, and to the favorable consideration of the City Government, as the
“facts presented to our said Committee show that Mr. Bartlett and his associates actually
“have the water required, at the requisite pressure, and claim to have all the legal rights
“necessary to deliver the same; and are willing to give ample financial guarantee that
“whatever contract made with him and associates by the City will be carried out promptly
“in good faith; therefore be it—

“Resolved, that the Committee be, and are hereby authorized to recommend Mr.
“Bartlett’s proposition to the favorable consideration of the Commissioners of the Sinking
“Fund, and urge upon them the adoption by the City of the proposition in accordance with

“ the plans submitted, in order to secure to the City an adequate supply of water for all purposes, and to meet its present needs, and that the same be done as promptly as possible.”

WM. W. HENSHAW,
Secretary.

For the purpose of presenting this matter to your Honorable Body, Mr. Henry H. Hall, the President of the Board, and Mr. E. R. Kennedy, of the Committee on Laws and Legislation, were added to the Committee.

It is hardly necessary for us to remind you, gentlemen, of the urgent and pressing need of an immediate addition to the present supply of water in this City, and of the danger to which property is exposed in consequence of the limited quantity of water and inadequate pressure which the Croton Aqueduct affords; these are matters familiar to you all and have been sufficiently urged before you by merchants and underwriters.

We have now presented a scheme which promises success, not a mere paper plan but one sufficiently wrought out to prove its practicability, and in the hands of parties able to carry out such contracts as they make; and in behalf of the New York Board of Fire Underwriters we urge you to give a careful examination to the plan laid before you by Mr. Bartlett and his associates, and if it commends itself to your judgment as it does to our own, we are confident that you will avail yourselves of this opportunity of securing for the lower part of the City, at an early day, an abundant supply of water delivered at a pressure sufficient to reach the tops of our high buildings without the introduction of fire engines.

With these suggestions we confidently leave the subject in your hands, and remain gentlemen,

Your obedient servants,

JOHN H. WASHBURN,
HENRY H. HALL,
E. R. KENNEDY,
WM. H. CROLIUS,
J. JAY NESTELL,
A. M. KIRBY,
CHARLES SEWALL,

Committee on Water Supply.

P. S. — We hand you herewith a petition to your Honorable Board, from prominent merchants and citizens of this City, calling for an independent supply of water, in sufficient quantity, under pressure available at all times for the protection of their property.

J. H. W.
Clnm.

To the Commissioners of the Sinking Fund of the City of New York:

GENTLEMEN:

We the undersigned merchants and citizens, doing business in the City of New York, respectfully call your attention to the alarming insufficiency of the present supply of water, and the great danger of destructive conflagrations in the business portion of the City. Each fire that occurs demonstrates the necessity of an independent supply, under pressure sufficient to meet the requirements of the fire department in extinguishing fires in high buildings.

In view of these facts, we respectfully petition your Honorable Board to take such action as may be necessary to ascertain if an adequate supply from some new and independent source can be obtained, that will be delivered to this city in the necessary quantity, and under sufficient pressure, available at all times for the protection of our property; and if such supply is obtainable, that you take the necessary steps as early as possible to secure the same, and thus further the well-being, safety and prosperity of the City.

H. B. CLAFIN & Co.
DUNHAM, BUCKLEY & Co.
J. W. GODDARD & SONS.
SWEETSER, PEMROKE & Co.
TEFFT, WELLER & Co.
FAULKNER, PAGE & Co.
PARKER, WILDER & Co.
W. L. STRONG & Co.
A. D. JUELLARD & Co.
LESLIE, WHITMAN & Co.
MORRISON, HERRIMAN & Co.
JOHN F. PLUMMER & Co.
BLISS, FABYAN & Co.
RUSSELL & ERWIN M'FG. Co.
PECK, STOW & WILCOX Co.
THURBER, WHYLAND & Co.
SARGENT & Co.
ACKER, MERRALL & CONDIT.
HUNTINGTON, HOPKINS & Co.
GARNER & Co.
HARPER & BROTHERS.
HOYT BROTHERS.
THE AMERICAN NEWS COMPANY.
S. W. JOHNSON, Treas.

REPORT OF BOARD OF ENGINEERS,
ON THE PLANS OF
JOHN R. BARTLETT,
TO FURNISH
ADDITIONAL WATER SUPPLY TO THE CITY OF NEW YORK.

NEW YORK, SEPTEMBER 15TH, 1887.

J. R. BARTLETT, ESQ.,

NO. 2 WALL STREET.

SIR :

In accordance with your request, we have carefully examined the plans proposed by you for furnishing a supply of pure and wholesome water for fire, business and domestic purposes to New York City, more especially to the lower part, the "Dry Goods District," and to the present high service districts, and have the honor to submit the following report :

The plan proposed looks to bringing into the lower part of this city a supply of some sixty millions of gallons of water daily, from a source entirely independent and distinct from the present source, and at any pressure, up to 350 feet of head, which may be found desirable by the officials of the City having the matter in charge.

The necessity for such a supply, in the lower part of the City, arises from the fact, which is well known, that in this section there is hardly any pressure upon the water pipes, and in consequence, this extremely rich portion is left in an extra hazardous condition in respect to danger from large conflagrations.

An abundant supply of water at High Bridge or in the Central Park reservoirs alone would not afford the desired relief, and give efficient fire protection, in consequence of the water not having sufficient elevation.

Such an abundant supply which will be assured to New York, upon the completion of the works now in progress and in contemplation, has its due value, and the lack of it

is a great burden upon and detriment to the City, and the procurement of such a supply deserves the earnest and continued attention of the citizens of New York.

But the lack of pressure in the pipes, in a large part of the City, is a matter distinct from that of available amount on hand, is no less to be considered, and calls for the promptest relief.

This lack of pressure in the lower part of the City, and the difficulty of relieving it, is brought about largely by the peculiar shape and situation of the City, upon a long and narrow island, jutting out into the sea, with its water supply entering it at one narrow end. In general it may be said that those of the consumers in a city who have the first chance to draw the water, may and do exercise that privilege to the full extent of their inclinations, and regardless of the effect thereby produced upon the taps of the consumers situated further down streams, which effect, in case of long lines of city pipes, and under usual conditions, is to deprive the lower consumer of a material portion of the pressure he should have. In the case of New York, it deprives him practically of the whole of it; and there is no relief from this evil, short of one or more special lines of main pipes which would carry water under pressure, intact, and with the least possible waste of pressure either past the upper consumer and into the district to be relieved, or else to reach that district with such pipes by new routes and from new sources of supply. Incidentally it may be said that at its best, the extreme available pressure from the Croton water works is not very great (119 feet above tide at the Central Park reservoir), and is insufficient to give a very good fire protection and to supply several high service districts within the City limits, which are now supplied by pumping stations.

To do away with these pumping stations, and instead, to supply all the high service districts from some one central source, of a proper and sufficient elevation, would result in a notable economy to the City. These high service districts consume at the present time about fifteen million gallons daily, and they constitute portions of the City which are growing with great rapidity.

The Croton water pressure is also insufficient properly to supply the many tall buildings in the lower part of the City, or to protect them from fire risks. These great structures are now supplied by pumping engines located within them; to draw their supply from the same central source of high pressure already alluded to, without pumping, would result in a notable economy to the owners and occupants thereof, and in the further and still greater economy of the largely reduced insurance rates, due to a better protection against large fires.

Besides the value of such an additional supply for fire protection and for economical ends there is still another point of view from which can be seen the great value of the additional supply which you desire to furnish. This point of view is the great necessity and desirability of supplying a dual system to a city of the size of New York. There can be no doubt that the danger of a water famine, with its attendant horrors and losses would be very materially lessened if New York had two independent sources of supply,

separated beyond the City limits by the Hudson River. Whether the assumed injury to one system of water supply be due to natural causes, to military occupation, or to temporary mob rule, it is but an elementary principle of business to provide duplicate means for the avoidance of disaster.

The Croton Aqueduct could be destroyed by accident or design, and the supply which you propose to furnish would remain; or your supply lines could be destroyed and the Croton supply remain. We cannot but consider such a duplication of supplies of inestimable value.

You propose to furnish this duplicate and additional water supply from that portion of the water-shed of the Passaic River which lies in Orange and Rockland counties, in the State of New York, by allowing the water to flow down its natural channels through the Ramapo and Wanaque rivers, to be pumped into a distributing reservoir situated in the Orange range of mountains, near Paterson, N. J., and thence allowed to flow by gravity to the City of New York, some fifteen miles distant.

This source is of sufficient elevation, and will furnish a quantity of water sufficient for all reasonable requirements of the City districts before alluded to. The water, according to all reports on the subject, is of unexceptionable quality; and the route which you propose for conducting these waters directly into the districts to be primarily relieved, we regard as well selected.

At Little Falls, which is only about eighteen miles from the City Hall, the Passaic River has a drainage area of about 830 square miles. Its least summer flow is about 125 million gallons daily, while a drainage area of that size may readily be made to yield with the aid of storage reservoirs, in this case yet to be constructed, about 450 million gallons daily, assuming that a sufficient amount of storage room be provided. Of the 830 square miles named, about 108 square miles, or one-eighth lie within the limits of the State of New York and are capable of furnishing one-eighth part of the daily yield, which has been named. As has been said, the quality of all this water is unexceptionable. The Orange range of mountains, near Paterson, at the Great Notch, so called, furnishes an admirable site for a distributing reservoir, only about 15 miles from the City Hall, with a full water elevation of 310 feet above tide, and capable of delivering water in the City of New York under 200 to 250 feet of head. This is a materially greater head than is usually met with in towns and cities. It would very perfectly supply the several high service districts, and the "Dry Goods District" of New York, giving them most excellent fire protection, feeding the tanks now in use in so many city buildings, and doing away with the pumping engines which now feed those tanks, and those which supply those districts.

If, however, it be desired to render available the unusual and very great head of 300 feet and over, which has been spoken of, within any part of New York City, that also can be furnished from the source of supply which has been named.

Very near the site of the Great Notch distributing reservoir lies an available site for another such reservoir, upon Garret Mountain, whose full water line would be 475 feet

elevation above tide, being capable of delivering water in New York City under some 350 to 400 feet head, though, naturally, at a proportionately greater cost per million gallons delivered.

In all these plans we assume, of course, that yourself and associates will control a right of way from the distributing reservoir to the shores of the Hudson River. To cross this river is the most difficult and novel feature of the plan under consideration, and we have accordingly given it due attention; and after carefully considering the matter we are of the opinion that this conveyance of water under pressure from the New Jersey shore into New York City must, to insure permanence, be made by means of pipes or conduits laid so as to be at all times accessible, inside of a tunnel or tunnels, driven under the channel of the river.

Fortunately there already is such a tunnel, originally planned, and large enough for a single track railroad, completed about one-third of the way across the river, and now progressing in a uniform and satisfactory manner. This work we find, upon a personal examination, is being conducted with great skill and forethought, and should be completed within two years. This tunnel is ample in size for containing water pipes of capacity sufficient to carry across to New York the supply already mentioned, as well as for containing other pipe lines, or electric wires, or any other similar means of communication. Or you can construct a new and smaller tunnel by the same process, about 12 feet in diameter, for the special purpose of carrying one or more large water conduits and these electrical cables and pipe lines. Such smaller tunnel could be built much easier and faster than the large tunnel, and in all probability could be completed from shore to shore in less than two years.

There are as yet comparatively few subaqueous tunnels; but there is already ample precedent for them, taking them altogether, and the accumulation of the results of experience had, is very instructive. Such tunnels have been built in soft ground in London (two of them), Antwerp (with the aid of compressed air), Chicago (two of them), Cleveland; and through rock at Boston, Buffalo and under the Mersey near Liverpool; and also under the Severn.

We have also considered the advisability of attempting to cross the Hudson River with the main pipes by laying such pipes on the bed of the river, either in form of flexible pipes, laid from scows or floats, or of rigid pipes laid and jointed under water. Such pipes have been laid in moderate depths, and in moderate currents, but there is no precedent for laying them of the capacity required, and across a river of the depth, and with the current of the Hudson River. The largest size flexible pipes thus far laid are 36 inches in diameter. Such pipes could not be laid upon the bed of the river, for in sinking into the soft bottom they would inevitably pull apart. It would be necessary to dredge a trench for them down to hard silt, in itself a costly operation when done, as it would have to be in this instance, in 60 feet of water.

When laid in such a trench, and covered with a layer of rip-rap, or with any other

structure capable of being built at a practicable cost in that depth of water, as a protection against anchors and other heavy bodies dropped into the water, they would still be subject to breakage. Vessels are not infrequently wrecked and sunk in the Hudson River, and any large vessel sunk over a line of pipe, laid in the manner stated, would almost certainly break it.

The only safety that could be secured would be in multiplying the lines of pipes, to the extent of having spare ones constantly laid; in placing them at say 500 feet distance apart, measured lengthwise of the channel; and in keeping a costly pipe laying plant constantly on hand, to relay broken pipe lines.

To state this proposition shows, we believe, its impracticability. No close estimate can be made for such a scheme, but we do estimate it as being more costly than the method of pipes laid in a tunnel. Flexible pipes have been laid at Toronto, Milwaukee, Jersey City, Philadelphia and Lawrence, Mass., but under widely different circumstances from those of the case in hand. At Chicago, the connection with Lake Michigan was twice made by tunnel under the lake, rather than by any form of laid pipe. This was done with an interval of ten years between the building of the two lake tunnels, constituting strong grounds for believing that the plan followed by Chicago was the wiser course, for that case. Other cities situated on the Great Lakes, have followed the example of Chicago, and have built subaqueous tunnels to connect their intake out in the lake with the pumps.

In all these cases, the conduit is not under pressure, and a brick tunnel lining suffices; while in the case under consideration, the tunnel would have to contain one or more wrought iron or steel conduits, to resist the pressure of the water to be conveyed across the river. We agree with the opinion which has been expressed, that this matter of the pressure of the contained water, while it constitutes a simple problem in the case of a rigid pipe, laid where it can at all times be got at, becomes a serious difficulty in case of a flexible pipe under great pressure, and laid across a deep and navigable river, with the bottom of soft silt. Such pipes leak more or less in all cases, and under the pressure herein considered, such leakage would rapidly increase, both in size of vent and in amount wasted thus speedily disabling the whole line of pipe.

And we cannot recommend a line of pipe laid on the bed of the river, either flexible or rigid, for the purpose of conveying a city water supply across the North River at New York City, whether this project be considered on the score of economy, or reliability or of durability.

But we do recommend as an entirely practical and valuable project, the general plan which has been submitted by you for supplying a portion of New York City from the drainage area of that part of the Passaic water-shed that lies in the State of New York, and in the manner herein described, including the use of a tunnel under the Hudson River for carrying the necessary water conduits across the river in a safe, durable, and trustworthy manner.

We summarize its principal advantages as follows:

1. It will furnish to the City of New York an independent supply of water from a new and independent source and by a new and independent route.

2 This supply will be delivered directly into those portions of the city most remote from the present source and where the pressure is most inadequate.

3. It can be delivered under any pressure desired up to 350 feet of head, and supply all high buildings and districts without pumping, thus resulting in a great saving to the City and to individuals.

4. It will furnish most perfect fire protection and consequently greatly reduce the cost of insurance.

All of which is respectfully submitted.

CLEMENS HERSCHEL,

Civil Engineer.

A. FTELEY,

Civil Engineer.

T. W. SYMONS,

Capt. Corps of Engineers, U.S.A.

LEGAL OPINION
OF
CLARENCE SEWARD AND ROSCOE CONKLING
ON THE
LAWS OF THE STATE OF NEW YORK RELATING TO THE SUPPLY OF NEW YORK CITY
WITH WATER FROM ROCKLAND AND ORANGE COUNTIES,
AND THE
POWERS OF THE COMMISSIONERS OF THE SINKING FUND TO OBTAIN SUCH A SUPPLY BY
CONTRACT WITH A PRIVATE CORPORATION.

NEW YORK, SEPTEMBER 23D, 1887.

J. R. BARTLETT, Esq.,
No. 2 WALL STREET, CITY.

DEAR SIR:

You propound the following inquiries:

1. Can a corporation be formed for supplying the City of New York with water?
2. If so, what are the rights, powers, and privileges of such corporation?
3. Can the municipal authorities of the City lawfully make with such corporation a contract for supplying the City with water?
4. If so, how is the contract price for such supply to be determined and paid?
5. If such contract were made, would the corporation, in order to fulfil it, have a right to lay pipes under the Hudson River, so as to bring a supply of water from its western shore?

In answer to these inquiries it is to be said:

1. The General Act of 1873 (Chap. 737), in relation to water works companies, is limited to towns and villages.
2. The General Corporation Act of 1848 (Chap. 40), as amended by the Act of 1880 (Chap. 85), authorizes the formation of corporations for "accumulating, storing, conducting, selling, furnishing and supplying water for domestic and municipal purposes," but Section 5 forbids the formation of such corporation for the conduct of the described business in the City of New York.
3. The powers of a corporation so formed were increased by the Act of 1881 (Chap. 472), but the prohibition against the formation of a corporation for supplying water in the City of New York was again repeated.



GREENWOOD LAKE.

Situated in the States of New York and New Jersey, about half in each State. It is 6 miles in length, 621 feet elevation above sea level, and contains about 2,600 acres of water surface. Its outlet flows through the Wanaque River, tributary to the Passaic.

AGRICULTURAL
UNIVERSITY
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4. This prohibition, however, has been so far modified by subsequent legislation as to be virtually repealed: thus, the Act of 1883 (Chap. 512), gives the Commissioners of the Sinking Fund of the City of New York power, in their discretion, to make and enter into a contract of lease for such period as they may determine, for securing a permanent supply of pure and wholesome water to meet the growing demands of the City, from the district embraced in the counties of Rockland and Orange, and authorizes such lease to be made "with any corporation formed or which may be formed under and pursuant to the authority conferred by Chapter 85 of the Laws of 1880, and Chapter 472 of the Laws of 1881, for the delivery by such corporation, from the district embraced in said counties of Rockland and Orange, to the City of New York, within two years from the date of such lease, of not less than fifty millions (50,000,000) of gallons of pure and wholesome water daily, during the continuance of such lease, with a pressure due to a head of three hundred feet above tide everywhere in the city, the water so to be delivered to be equal in purity to the water supplied from the Croton system, and the rate of compensation therefor not to exceed for each million of gallons supplied the actual cost during the year 1882, of each million of gallons supplied to the city from the Croton system during such year, as shown by the actual expenditure by the city during the year; and which lease may provide for the purchase by the city of all the rights and interests of the said corporation in and to the water rights and grants obtained and secured by them, and the works constructed by them for the delivery in said City of fifty millions of gallons of water daily, when the said Commissioners of the Sinking Fund shall deem such purchase to be for the interest of the city; provided such purchase is determined upon by said Commissioners within three years from the date of the completion of such works, and that the cost of said purchase shall not exceed the sum of six millions of dollars, ***and the expense of such works shall be provided as authorized by Chapter 328 of the Laws of 1871, in addition to the amount by that Statute authorized to be raised as therein provided."

It is further, by the Act of 1883, provided, that "Whenever the said Commissioners of the Sinking Fund shall deem it to be for the best interest of the City, they may authorize the construction of a special fire service in connection with the supply of water hereby provided for, for the use of the dry goods district of the City, so-called, and [to] make and enter into such contracts and arrangements with the said company as may be necessary for this purpose, and [to] fix and determine the rental of each occupant and owner in said district, for the use and service thereof, and upon the faith and credit of such rental, [to] authorize the Comptroller of said City, to borrow on the bonds of the City such sum as may be found necessary to meet the expense of constructing such service, not exceeding One Million dollars."

This Act authorizes the formation of a water company to supply water to the City of New York, from the district embraced in the counties of Rockland and Orange. Such company would be formed pursuant to the General Corporation Act of 1848, and the Acts

of 1880 and 1881, above referred to, and when formed such corporation would have a right and power to "lay pipes for the purpose of conducting water for the purposes of their business, under any of the navigable waters of this State, provided they are so laid "as not to interfere with the navigation of such waters," and to acquire all necessary shore rights therefor under the provisions of said Act of 1881.

Further than this, the prohibition contained in the Acts of 1880 and 1881 against the formation of a corporation for supplying the City of New York with water was further modified by the Act of 1884 (Chap. 386), so as to permit the formation of a corporation under the General Act of 1848, "for the purpose of boring, sinking, digging for, accumulating, conducting by underground pipes, conduits and reservoirs, and furnishing water to be "used for power and fire purposes," to be used anywhere and everywhere, and with power to lay its pipes and conduits in the Streets and Avenues, of the City of New York with the consent, and by the authority of the Commissioners of the Sinking Fund of that City.

Such Commissioners are empowered under the Act of 1884 (Chap. 292) to "authorize "the construction of a special water service for fire, sanitary and other purposes in said City "of New York, or may make and enter into contracts and agreements for a term of years*** "with any corporation duly organized under the Laws of this State for the furnishing of a "special water service for fire and sanitary and other purposes, and for supplying water "suitable therefor from any source, with a pressure equal to a head of three hundred feet "above tide water, upon such terms as they may deem best, and in such contract to "authorize the corporation to lay down pipes and erect hydrants in the streets.* * * The "compensation agreed to be paid under any such contract * * * shall be provided for by "the Board of Estimate and Appointment, [Apportionment,] and included in the final "estimates." The City may purchase the rights and interests of the corporation if it determine upon such purpose at the expiration of five years from the date of the contract, and issue and sell bonds to provide for the purchase money. The Commissioners of Public Works may fix the rates and charges for the use of said water, and such rates are made a lien collectible in the same manner as ordinary water taxes, and this power of the Commissioners is further re-inforced by the Act of 1887 (Chap. 559).

By this Act of 1884 (Chap. 386), any corporation formed thereunder may contract with any city to furnish water for the purposes stated in Section 1 of said Act, that is for power and fire purposes, but in the City of New York, such contract must be made by the Commissioners of the Sinking Fund, upon such terms and conditions as said Commissioners shall deem for the best interests of said City, and the Comptroller is authorized to issue revenue bonds of said City of sufficient amount to raise such sum as the Commissioners shall certify to be necessary to execute any contract made in behalf of said City under the authority conferred, and a sum sufficient to pay said bonds with interest shall be included in the final estimate and raised by taxation, either in the year in which such bonds were issued or in the following year.

The New York Consolidation Act of 1882 (Chap. 410 Sec. 170) contains this provision: "There shall continue to be a Board of Commissioners of the Sinking Fund, composed of the Mayor, Recorder, Chamberlain, Comptroller and Chairman of the Finance Committee of the Board of Aldermen."

It results therefore that under existing laws,

FIRST.—A corporation may be formed for the purpose of supplying the City of New York with pure and wholesome water, to be drawn from the district embraced in the counties of Rockland and Orange.

SECOND.—A corporation may be formed for the purposes of boring, sinking, digging for, accumulating, conducting by underground pipes, conduits and reservoirs, and furnishing water to be used for power and fire purposes in the City of New York and elsewhere.

THIRD.—Such corporation would have all the rights, powers and privileges conferred by the General Laws of 1848, as amended by Chapter 85 of the Laws of 1880, and Chapter 472 of the Laws of 1881, and the other Acts cited, including among such powers, the power to erect reservoirs and lay pipes and erect hydrants, and the power above specified of laying the pipes under the Hudson River, for the purpose of conducting water for the purposes of their business.

FOURTH.—The Commissioners of the Sinking Fund, under Chapter 512 of the Laws of 1883, and Chapter 292 of the Laws of 1884, have full power and authority to make a contract with such corporation for the purpose of affording a permanent supply of pure and wholesome water to meet the growing demands of the City from the district embraced in the counties of Rockland and Orange, and for fire, sanitary and other purposes, from whatever source such water may be drawn. The use of the word "power" is not to be limited to merely mechanical power, but fairly implies all purposes in which the force of the water, that is its power, would be useful, as it would be for "sanitary" and presumably for all "other purposes."

FIFTH.—The contracts to be made under Chapter 512 of the Laws of 1883, and under Chapter 292 of the Laws of 1884, are authorized to be made for a term of years, and therefore imply that a rental is to be paid thereunder by the City. How such rental is to be paid under the Act of 1883, is not specified, but presumably it could be paid as the other expenditures of the City are paid for the conduct of public business upon the request of the proper department, or it could be paid in the precise manner in which it is authorized to be paid by the Act of 1884, which provides that "The compensation agreed to be paid under any such contract *** shall be provided for by the Board of Estimate and Apportionment [Apportionment] of the City of New York, and included in the final estimates made by said Board." If the contract were made under Chapter 386 of the Laws of 1884, it would seem that such contract may provide for a rental as well as for the sum in gross, which the City is to pay for the supply.

SIXTH.—The rental and purchase price are to be agreed upon by the contracting par-

ties. The rental is to be paid as other expenditures of the City are paid, or to be provided by the Board of Estimate and Appointment. [Apportionment.]

Under the Act of 1883, the purchase money therein provided, to an amount not exceeding six million dollars, is to be paid by the issue and sale of City Bonds, under Chapter 328 of the Laws of 1871. If the purchase is made under Chapter 292 of the Laws of 1884, then the purchase money is to be raised by the issuance and sale of "special water service" bonds. If the purchase be made under Chapter 386 of the Laws of 1884, "revenue" bonds of the City are to be issued and sold.

There is no doubt, therefore—

1. That a water company organized under the Laws of this State, has ample and full power to procure, deliver and sell water to the City of New York.

2. That the Commissioners of the Sinking Fund of the City have ample and full powers according to law to contract for a suitable supply from such water company to fill all the needs and requirements of the City of New York for any purpose.

3. That the said Sinking Fund Commissioners have the right according to law to pay for such supply, delivered into the City of New York, as follows:

(a) Delivered pursuant to Chapter 512 of the Laws of 1883, "the compensation not to exceed for each million gallons supplied, the actual cost during the year 1882, of each "million gallons supplied to the city from the Croton system during such year as shown "by the actual expenditure by the city during the year."

(b) If delivered under the provisions of Chapter 292 of the Laws of 1884, to pay therefor such compensation "as they (the Commissioners of the Sinking Fund) deem "best."

(c) That the Commissioners of the Sinking Fund have a right, under Chapter 512 of the Laws of 1883, to purchase the interest of the Company for a sum not exceeding six million dollars, and under Chapter 292 of the Laws of 1884, to make such purchase for such sum as "shall be determined by arbitrators appointed by the Supreme Court," and

(d) Under Chapter 386 of the Laws of 1884, to make such purchase for "such sums "as the said Commissioners of the Sinking Fund shall certify to be necessary."

4. The Commissioners of the Sinking Fund are authorized to empower such water company to erect reservoirs, and to lay pipes and conduits, and erect hydrants in the City of New York, necessary to secure and utilize the supply of such water, and such company is also authorized to lay such pipes under any of the navigable waters of the State for the purpose of delivering water from the district embraced in the counties of Rockland and Orange.

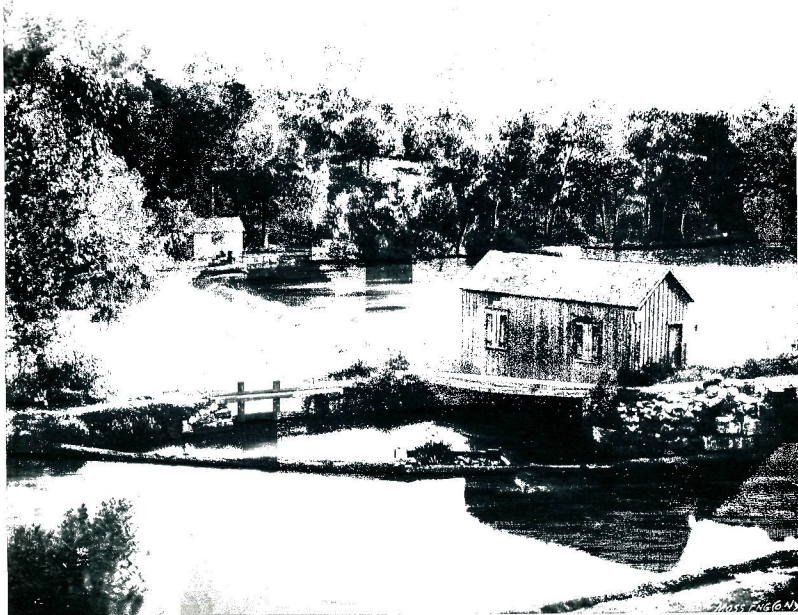
Very respectfully yours,

CLARENCE A. SEWARD.

I concur in the foregoing opinion,

ROSCOE CONKLING.

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THE ROCKAWAY RIVER.

At the Boonton Falls, showing the intake of the Morris Canal. Elevation above tide water about 560 feet.

MEMORIAL OF FIRE UNDERWRITERS
TO THE
COMMISSIONERS OF THE SINKING FUND OF THE CITY OF NEW YORK.

PRELIMINARY STATEMENT.

The alarming inadequacy of the water supply in most parts of the City, has been repeatedly disclosed at fires within the last few years. This it is supposed will be remedied when the new Croton Aqueduct is completed and in use, but in view of the project of Mr. John R. Bartlett and his associates, for introducing water from Rockland and Orange counties, the undersigned respectfully submit that, after investigation by the New York Board of Fire Underwriters, through its standing committee on water supply:

First. That the existing scarcity of water can be remedied probably several years earlier by Mr. Bartlett's proposition than through the new Croton Aqueduct.

Second. That even after the Aqueduct, now building, is finished and in use, and conceding that the quantity of water then supplied will be abundant for all purposes, the pressure under which it will be delivered throughout the City will not be much greater than at present.

Third. Experience has repeatedly shown, and it is conceded by the leading engineers of the Fire Department that with the present methods of extinguishing fires, the efficiency of our Department is greatly diminished where any fire exists more than 65 feet above the ground, and there are hundreds of buildings already in the City, most of which are not incombustible, and in such instances as are entirely fire-proof, the contents of such buildings are as combustible as if they were in other buildings, where fires would be entirely beyond the reach of the engines now in use. There have already been a number of fires where the firemen have had to stand by and wait for the fire to burn down within reach of their extinguishing apparatus before they could undertake to do anything. The tendency to erect lofty buildings is increasing, and this adds to a difficulty which, as just stated, already exists, and demands methods adaptable to this condition for extinguishing fires, quite as much as the growth of the City years ago demanded the substitution of steam for hand engines.

Fourth. As above recited, the additional supply of Croton water will not remedy this already great and growing menace to the property of this City.

Fifth. The undersigned are advised, and after investigation are convinced, that the water proposed to be introduced by Mr. Bartlett can be delivered in the City of New York under such a pressure from gravity, that it could be carried by iron pipes, and by

such means as the inventive ingenuity of the City would doubtless supply, to the tops of the tallest buildings, in such quantities, and with such force, even at the highest points, that it would be as instantly available for the extinguishing of fires in these buildings as would be the water so conveniently turned on in any wash-basin to-day.

The proposed method of projecting water upon fires, would greatly reduce the cost of that service as administered at present, and at the same time vastly add to the efficiency of the means of extinguishing by the application of water :

1st. It would enable a few men with a light hose carriage to reach the point of fire much quicker than the present heavy engines to-day, and at the breaking out of a fire a minute is sometimes worth a million dollars, and frequently a hundred thousand.

2nd. It would enable the firemen, by the use of permanent stand pipes to connect short lengths of hose and apply the water in large streams and solid masses, whereas, at present, even when two or three engines are forcing water through a single pipe, or tower, the stream is largely converted into spray, before it reaches the fire, and is then converted into steam, and even into a gas that aids combustion rather than stops it.

The undersigned officers, managers, and agents of fire insurance companies, doing business in the City of New York, therefore cordially recommend to the Sinking Fund Commissioners, a contract with Mr Bartlett and his associates, by which the water supply they now control may be at once introduced into the City of New York.

New York, 20th October, 1888.

J. H. WASHBURN, V-Pres., Home Ins. Co.

E. A. WALTON, Pres., Citizen's Ins. Co.

GEO. M. COIT, Agent, Hartford Fire and other Ins. Cos.

LIBERTY INS. CO., Weed & Kennedy, Managers.

HENRY H. HALL, Manager, Northern Assurance Co. of London.

WM. H. CROLIUS, Sec'y, American Fire Ins. Co., N. Y.

CHARLES SEWALL, Manager, Commercial Union Assurance Co., Ltd.

KIRBY & DWIGHT, Agents. { Boatman's Fire Ins. Co. of Pittsburgh.
People's Fire Ins. Co. of Pittsburgh.

People's Fire Ins. Co. of Pittsburgh.

E. B. MAGNUS, Prest., Broadway Ins. Co.

GEO. P. SHELDON, Prest., Phoenix Ins. Co.

RUD. GARRIGUE, Prest., Germania Fire Ins. Co.

N. Y. BOWERY FIRE INS. CO., Chas. A. Blauvelt, Sec't.

B. S. WALCOTT, Prest., Hanover Fire Ins. Co.

J. F. HALSTED, Pres., Firemen's Ins. Co.

D. D. WHITNEY, Prest., Hamilton Ins. Co.

WALTER K. PAYE, Prest., Guardian Ins. Co.

ALFRED A. REEVES, Prest., Globe Fire Ins. Co.

DAVID J. BURTIS, Sec'ty, Empire City Fire Ins. Co.

F. V. PRICE, Prest., People's Ins. Co.

W. W. UNDERHILL, Prest., United States Fire Ins. Co.
 SAM'L VAN WYCK, Prest., Lafayette Fire Ins. Co.
 W. JAFFRAY, Pres., Park Fire Ins. Co.
 A. COLSON, Sec'ty, New York Fire Ins. Co.
 JAS. A. ALEXANDER, Agt., Aetna Ins. Co. of Hartford.
 HENRY A. OAKLEY, Prest., Howard Ins. Co. of New York.
 W. M. ST. JOHN, Prest., Standard Fire Ins. Co.
 JOHN MILLER, Prest., N. Y. Equitable Ins. Co.
 A. J. CLINTON, Prest., Eagle Fire Co.
 J. D. VANVALKENBURGH, JR., Gen. Agt., American Central Ins. Co.
 G. H. MARKS, Manager, London Assurance Corporation, per W. E. Caldwell.
 A. D. IRVING, Manager, Phoenix Assurance Co. of London.
 WILLIAM W. HENSHAW, Asst. Manager, Royal Ins. Co.
 HARRO HNEN, Asst. Manager, Transatlantic Fire Ins. Co.
 HARBERS & HNEN, Agts., Farmer's Fire Ins. Co.
 JAMES S. HOLLINSHEAD, Agt., Ins. Co. of North America.
 LONDON & LANCASHIRE FIRE INS. CO., E. E. Pearce, Local Sec'ty.
 JOHN M. WHITON, Agent, $\left\{ \begin{array}{l} \text{British Am. Ins. Co.} \\ \text{St. Paul Fire \& Marine Ins. Co. of St. Paul.} \end{array} \right.$
 J. J. PURCELL, Sec'ty, Sun Fire Office of London.
 F. O. AFFELD, Manager, Hamburg Bremen Fire Ins. Co.
 J. A. MACDONALD, Manager, Queen Ins. Co.
 WM. A. FRANCIS, Asst. Manager, North British & Mercantile Ins. Co.
 X. W. MESEROLE, Asst. Man., Guardian Assurance Co. of London.
 H. W. EATON, Resident Manager, Liverpool & London & Globe Ins. Co.
 J. H. KATTENSTROTH, Sec'ty, National Fire Ins. Co. of N. Y.
 SAM'L E. BELCHER, Pres., Jefferson Ins. Co. N. Y.
 ACKERMAN, DEYO & HILLIARD, Agts. $\left\{ \begin{array}{l} \text{Scottish Union \& National Ins. Co.} \\ \text{North Am. Fire Ins. Co.} \\ \text{Citizen's Ins. Co. of Cincinnati.} \\ \text{Man'fac'rs \& Merchants' Ins. Co.} \\ \text{Heckla Ins. Co.} \\ \text{Armenia Ins. Co. of Pittsburgh.} \end{array} \right.$
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 GEO. R. CRAWFORD, Prest., Westchester Fire Ins. Co.
 R. CARMAN COMBES, Pres't Exchange Fire Ins. Co.

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 Rutgers Fire Ins. Co., J. F. HANFORD, Sect'y
 HENRY HONIG & SON, Agents. { Girard of Phila. and
 Franklin Ins. Co., Columbus, Ohio.
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 E. LITCHFIELD, Manager, Lancashire Ins. Co. of England.
 Imperial Fire Ins. Co., England. }
 City of London Ins. Co., England. }
 Lion Ins. Co., London. }
 Fire Association, Philadelphia. } CHAS. M. PECK & CO., Managers,
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 United Firemen's Ins. Co., Philadelphia, }
 Mechanic's Ins. Co., Philadelphia. }
 Firemen's Fund Ins. Co., California. }
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 Mercantile F. & M. Ins. Co., of Boston.
 Packers' & Provision Dealers' Ins. Co. of Chicago.
 Neptune F. & M. Ins. Co. }
 Spring Garden " " }
 County of Phil. " " }
 California " " } WEED & KENNEDY, Agents.
 Mercantile of O. " " }
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SCOTT & TALBOT, Agents, { Connecticut Fire Ins. Co.
Providence Washington Ins. Co.
B. LOCKWOOD, Man'gr. { Ins. Co., North America.
Ins. Co., State of Pennsylvania.
E. W. ALBRO, President Knickerbocker Fire Ins. Co.
Western Assurance Co. of Toronto.
Union Ins. Co. of California.
Security Ins. Co. of Connecticut.
Atlantic F. & M. Ins. Co. of Providence. } ROOSEVELT & BOUGHTON, Agts.
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Equitable Fire & M. Ins. Co. of Providence, R.I. } D. ADEE, Agent.
Merchants' Ins. Co. of Providence, R. I. }
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Detroit F. & M. Ins. Co. }
Reading Fire Ins. Co. } HAROLD HERRICK, Agent.
Citizens Ins. Co., Mo. }
CONCORDIA FIRE INS. CO. of Milwaukee, Wis., Charles E. W. Chambers, Agt.
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CHARLES S. BARTOW, Sec'y Commonwealth Ins. Co. of N. Y.
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J. A. SILVEY, Sec'y German American Ins. Co.
American Fire Ins. Co. of Philadelphia.
Pennsylvania Fire Ins. Co. " " }
Boylston Ins. Co. of Boston. } FRAME & SHADE, Agents.
Firemen's Ins. Co. of Boston. }
Western Ins. Co. of Pittsburgh. }
MASON A. STONE, Sec'y of the Greenwich Ins. Co.

RIPARIAN RIGHTS

ON THE PASSAIC RIVER AND ITS TRIBUTARIES.

THE SOCIETY FOR ESTABLISHING USEFUL MANUFACTURES AND THE MORRIS CANAL AND BANKING COMPANY.

TO THE COMMISSIONERS OF THE SINKING FUND
OF THE CITY OF NEW YORK:

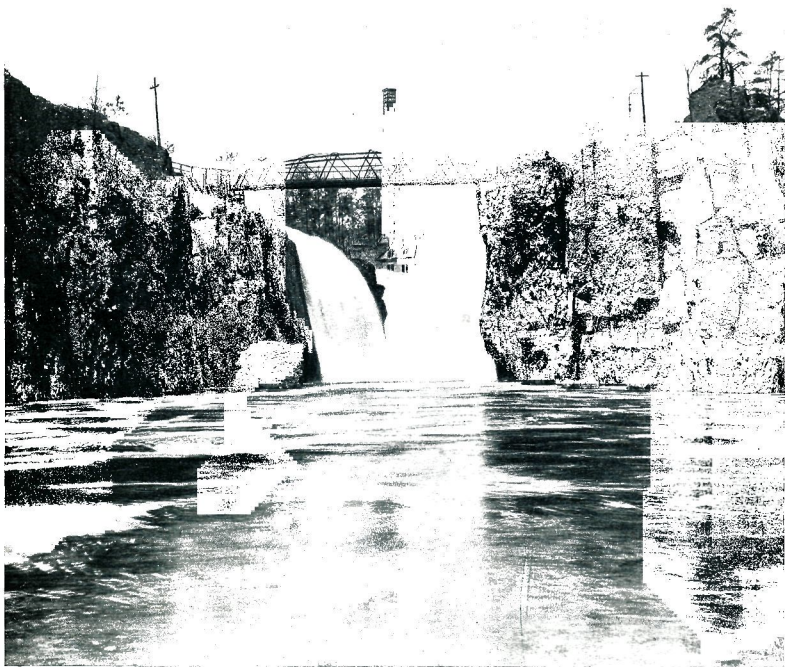
GENTLEMEN:

Nearly one hundred years ago a distinguished company of patriotic men, Alexander Hamilton, then Treasurer of the United States, Judge Boudinot, Richard Stockton, John Neilson, Archibald Mercer, Nicholas Low, John Bayard, Robert Troup, Brockholst Livingston and others, met in this city to devise some practical way of inaugurating in this country the manufacture of textile fabrics, and such articles as the country required for its own use, that the nation might become independent of Great Britain, from whom, at that time, nearly all manufactures used in this country were imported.

Under the able leadership of Hamilton a permanent organization was effected. They sent to France for a practical chemist to examine, analyze and report on the quality of the water flowing in the various rivers emptying into the Atlantic. This chemist reported that the Passaic River in the State of New Jersey contained the purest water for the reason that the Passaic water-shed was composed of trap-rock, conglomerate and granitic formations and the soil of its forest-clad mountains contained less deleterious matter soluble in water than on any other water-shed on the Atlantic seaboard.

They applied to the State of New Jersey for a charter, which was drawn by Hamilton, which gave to them extensive and valuable franchises, viz: the right to engage in manufacturing, to do a banking business, to build canals and operate them, to run lotteries and to build a city, appoint judges and do all and everything appertaining to the exercise of such varied powers—the most wonderful charter probably ever granted in this country.

They named their association “The Society for Establishing Useful Manufactures.” They purchased 700 acres on the Passaic River, including the Great Falls, which furnished ample motive power as well as plenty of pure water. They employed the famous French engineer, Major Charles L’Enfant, the friend of Washington, Hamilton and Lafayette, who had just completed mapping out the City of Washington, our national capitol. They built their first raceway, erected a mill and named the town “Paterson,” after the then governor of the State, who signed their charter. The then infant town is



THE GREAT FALLS.

(70 feet head and fall.)

On the Passaic River, in the City of Paterson, 15 miles from New York. Elevation above tide water 116 feet. Owned and used for the past 100 years by the Society for Establishing Useful Manufactures to furnish motive power to their tenants, the manufacturing industries of the City of Paterson.

now a thriving city of 70,000 inhabitants, the headquarters of the silk and locomotive industries of America. On the raceways of the Society there are at present employed in manufacturing over twelve thousand operatives and many millions of capital; all of which is the result of the enterprise of the men who created the Society for Establishing Useful Manufactures.

The society is a riparian proprietor, and has to-day, by virtue of such proprietorship and of nearly one hundred years uninterrupted use, the exclusive right to use all the water of the Passaic River and its tributaries, at the Great Falls, as nature causes said water to flow without diminution or alteration above them.

Therefore it follows that no water flowing in the Passaic River, or any of its tributaries, viz., the Ramapo, Wanaque, Pequannock, Rockaway and other rivers or streams in the Passaic water-shed, can be diverted from their natural channels for any purpose without the consent of the society and other riparian proprietors below the point of diversion except by the exercise of the power of eminent domain and the payment of adequate compensation, and also guaranteeing to the manufacturers at Paterson that the quantity of water owned and used by them shall not be impaired, which amount in the aggregate already exceeds the minimum flow of the river.

This necessitates the construction of large reservoirs to hold back and store a portion of the maximum or surplus waters flowing away to the sea, during the wet season, in order to secure ample supplies for the cities and towns dependent on the Passaic water-shed, during the dry season. If this is not done, the same result would be partially accomplished by the purchase of all the water power at the Great Falls for manufacturing purposes in the City of Paterson and elsewhere on the river.

In support of the foregoing I have the honor to submit herewith for your perusal the legal opinions of the riparian rights of the Passaic River and its tributaries, from eminent counsel having special knowledge of the subject; to wit., Hon. Benjamin Williamson, Chancellor of the State for seven years; Ex-Gov. J. D. Bedle, for ten years Justice of the Supreme Court; Ex-Gov. Leon Abbett; Henry C. Pitney, Esq., author of the water laws of the State; Hon. Garret A. Hobart, of Paterson; A. Q. Keasbey, Esq., of Newark; William Pennington, Esq., counsel for the Society at Paterson, and Henry C. Andrews, Esq., of New York.

MORRIS CANAL AND BANKING COMPANY.

(Morris Canal.)

The riparian proprietors of the Passaic River however, do not own all of its sources of water supply. The Morris Canal & Banking Co. have exclusive and valuable water privileges which they secured during the construction of the Morris Canal for purposes of navigation, by purchase and the exercise of the power of condemnation rights, granted them in their charter. This company was organized in 1824, prior to the era of railroads, in the days when canals were looked upon as the only means of cheap transportation. It

was a great undertaking and considered a great public work, and received unusual franchises and favors from the State and the people in consideration of the fact that the large amount of capital required to construct it was furnished wholly by the incorporators and their friends. They acquired extensive and valuable water rights at Greenwood Lake, lying chiefly in the State of New York, and at Lake Hopatcong, on the crest of the divide between the Hudson and the Delaware rivers, by purchase and condemnation of the shore lines. Dams were built and the water in these large lakes raised at least sixteen feet above the old levels, giving to the Morris Canal & Banking Co. a vast storage area of at least 5,000 acres of pure water sixteen feet deep, amounting in the aggregate to over 26 billion gallons, exceeding the whole storage capacity of the Croton water-shed at the present time. These vast storage reservoirs have been used more than half a century for feeding the canal levels. The canal also crosses the Passaic River and its tributaries at different points, drawing water therefrom where the crossing is at the level of the river. It crosses the water-shed from east to west from the Hudson River to the Delaware, rising in its passage over the rocky divide to an altitude of nearly 1,000 feet above tide water. The building of this great work presented some engineering problems of an unusual character in canal construction, which were ingeniously overcome by the able engineers of the company, by the use of inclined planes on which the boats are taken out of the canal and carried on wheels drawn on these inclines by water power furnished from the higher levels of the canal.

The Morris Canal is in effect an artificial high level river, flowing parallel with the lower Passaic, having a capacity of about sixty cubic feet of water per second during the season of navigation, and holding in reserve the vast reservoirs of Greenwood Lake and Lake Hopatcong as feeders. Its water sources are pure and independent of the natural flow of the river and streams.

The Legislature of the State of New Jersey, at its last session, authorized the company, or its lessees, to discontinue navigation and to sell the water and sources of water supply controlled by it. When navigation is discontinued the water used for that purpose and the large reservoirs mentioned can be applied to another and more important public purpose, viz., the supply of cities and towns with pure and wholesome water.

Respectfully yours,

J. R. BARTLETT.

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LAKE HOPATCONG.

Situated nearly on the divide between the Hudson and Delaware rivers, with an elevation above sea level of 926 feet, and contains about 2,800 acres of water surface. It is of uneven depth, in some places 150 feet.

1. 1914-15
2. 1915-16
3. 1916-17
4. 1917-18
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OPINION OF EX-CHANCELLOR WILLIAMSON.

The Society for Establishing Useful Manufactures was incorporated by the Legislature of New Jersey in 1791, and as expressed in its charter "for the purpose of establishing a company for carrying on the business of manufactures in this State." The powers and provisions of the charter were ample and generous to effect the object contemplated and to project and anticipate future developments on a scale of great magnitude. Its capital was four millions of dollars, with authority among other things, to purchase lands, tenements and hereditaments, to cut canals, to clean and improve the channels of rivers, and to acquire the right and title to all streams and rivers in anticipation of the necessities for the full enjoyment of the object contemplated.

In an opinion of a Chancellor of New Jersey, in a most important litigation, involving the rights of the Society to the enjoyment of the waters of the river Passaic and its tributaries, he says:

"Soon after the passing of the charter, the Society was organized, and in 1792 a "situation at the Great Falls of the Passaic River was made choice of as a suitable place "for the principal seat of their said manufactures."

"They purchased the old mill seat and upwards of seven hundred acres of land, with "the bed of the river both above and below the falls. They expended large sums of money "to create a great water power, to carry on their manufacturing operations with. They "constructed a canal, or water course, a short distance above the falls, to lead the waters "of the Passaic River through the lands of the Society and return them again into the "bed of the river. They also threw a dam across the river and formed a sluice or race- "way by which the water was carried into a large basin, or reservoir, from which it was "to be carried into the canal which they had constructed, and such others as they should "construct for multiplying sites for manufacturing establishments, and they thus appropri- "ated by occupancy, the waters of the Passaic to the purposes of the institution."

The Society appropriated, by occupancy, the whole water of the Passaic River, as it had a right to do under its charter; and as riparian owners acquired the right to the flow of the whole of the waters of the Passaic River and its tributaries in their accustomed and ancient channels.

It is a matter of settled judicial decision by the Courts of New Jersey, and so fully determined that it cannot now be questioned, that neither by legislative grant, or otherwise, can the waters of the Passaic River be diverted, except by consent of the Society, unless by condemnation under the application of the doctrine of *Eminent Domain*.

The ownership of the Society, by purchase or occupancy, acquired under and by virtue of its charter, to the use of the whole of the waters of the Passaic at and above the Great Falls, is so well established by judicial authority, that it may be assumed with perfect security that by any powers, acquired or to be acquired, of the cities of Jersey City or Newark, or other municipalities, or of any private water company incorporated under the Laws of the State of New Jersey, the waters of the Passaic above the Great Falls cannot be diverted without the consent of the Society, except by the exercise of the power of *Eminent Domain*.

The Court of Chancery would without doubt enjoin any municipality or any company from such diversion, without having first made compensation, either by agreement with the Society or by condemnation by legislative authority.

Assuming that the corporations referred to, or any private company, have legal authority to agree with persons who own or control water or water rights, has the Society a right to contract with such cities or water companies, for the diversion of any surplus water over and above its present necessities for existing water contracts?

The exercise of such right by the Society could not be interfered with, except by the State of New Jersey, or by some individual who could show actual damage or injury by such diversion, to his right to the use of such water so diverted.

I think it clear that the State would have no authority to interfere with the exercise of such right by the Society. The powers conferred contemplated immediate and heavy outlays for acquiring water in anticipation of supplies for future use; and the right to buy and sell water, from time to time, which it has the right to acquire and hold, is an inherent right, just as is the right to acquire and hold any other property. There is no restraint on its power to sell absolutely, and if such power to sell exists, it includes the power to make a more limited disposition of it.

But I do not even suggest the many reasons which lead me to the conclusion which I affirm without hesitation, that the State would not, and could not interfere with the exercise of the right in question.

As to individual rights I have no hesitation in reaching this conclusion, "that as long as the supply to the mill owners is not diminished, and the ordinary flow of the water below in the river is not decreased" the Society can "by reason of its actual ownership, dispose of all surplus waters to cities, towns, etc., authorized to contract therefor."

May 25, 1886.

B. WILLIAMSON.

To J. R. BARTLETT, Esq.,
No. 2 Wall St.

OPINION OF HON. J. D. BEDLE.

JERSEY CITY, May 25th, 1886.

JOHN R. BARTLETT, ESQ.

DEAR SIR:

I am pleased to give you my views in brief of the rights and powers of the Society for Establishing Useful Manufactures, at Paterson, upon the subjects concerning which you make inquiry.

1. The right of the Society to the flow of all the waters of the Passaic at the Great Falls I regard as settled by adjudication in this State, and consider the title of the Society in that respect clear.

2. The right to accumulate waters at the Great Falls to the full extent and power of the dam I think is undoubted.

3. In my judgment no municipality or private water company has a right to take or divert, as against the Society, any of the waters of the Passaic which would flow naturally over the dam of the Society, without its assent.

4. No municipality or private water company, in my opinion, can divert any of said waters, without first making compensation to the Society, either by agreement or by proceedings of condemnation, and for that purpose legislative authority would be necessary, and any material interference with the rights of the Society in this respect would be protected by injunction.

5. In my judgment the Society could, by reason of its actual ownership, dispose of all surplus waters to cities, towns, etc., authorized to contract therefor, as long as the supply to its mill owners is not diminished, and the ordinary flow of the water below the Great Falls is not decreased. This power is inherent in the right of property, and necessarily incident to the corporate rights of the Society.

I give you this as my professional opinion, inasmuch as you desire it, although I am Deputy Governor and Council of the Society.

Yours very truly,

J. D. BEDLE.

OPINION OF HON. LEON ABBETT.

NEW YORK, June 3d, 1886.

MESSRS. H. C. FAHNESTOCK AND EDWARD D. ADAMS.

GENTLEMEN :

In accordance with your request, made during our interview of May 28th, I herewith give you my views with reference to the powers of the Society for Establishing Useful Manufactures to make an agreement by which its surplus water may be stored and used for water supplies to cities.

The Chancellor, in the case of the Society for Establishing Useful Manufactures v. The Morris Canal Co, (1 Saxton, 187), in October, 1830, states as follows :—

“The river Passaic at the Town of Paterson, is not a navigable stream. The tide “does not ebb and flow, nor is the stream navigable by boats or craft of any kind. The “Society, at the place selected as the seat of their manufactories, own the land on both “sides of the river and have had the possession for many years. They are the riparian “proprietors, and upon plain and acknowledged common law principles they are entitled “to the use of the stream. They have in it a property, growing out of the ownership of “the soil, which is oftentimes of more value than the soil itself, and at all times as sacredly “regarded by the law. This being the case, they have a right to enjoy it without “diminution or alteration. * * * This right, at all times valuable, is to the Society vital. Their “hopes and expectations not only, but their very existence are dependent on it. The “right is not confined to the use of so much water as may be necessary for their present “purposes. They have appropriated to themselves the use of the stream. They have a “right to take out the whole it of for the purposes of their manufactories, provided it is “again, after being used, restored to the bed of the river for the benefit of those below ; “and provided also that no one having prior rights is thereby injured. Such I take to “be the common law rights of the Society, independent of any additional privileges that “may be granted to them by their charter.”

The Society was chartered for the purpose of “carrying on the business of manufactures in this State” (New Jersey), and its incidental and additional powers were given to enable it to carry out the intention of the Legislature as set forth in the preamble of the act passed November 22nd, 1791. The Legislature desired the introduction and establishment of useful manufactures in New Jersey, and the Courts have held that the canals and improvements made to supply water power to other manufacturers at Paterson were a lawful exercise of chartered rights.

There is no authority in the Society's charter authorizing it to supply potable water to cities or localities, or to enter into any contract to do so.

The Society's control of the waters and tributaries of the Passaic for manufacturing purposes, both for present and future uses, practically prevents the use of any of these waters, unless the assent of the Society is obtained for the diminution of its supply, or the power of condemnation is exercised by some corporation lawfully authorized to condemn water and water rights, so as to use the water for supplying cities or places with potable water. The Society can make an agreement with such authorized corporation, assenting to its use of so much water as it may need, and may take compensation for such assent, either in one sum or by periodical payments. Such assent is not in violation of the charter of the Society, because there is no requirement therein that compels the Society to presently use all the water it controls. The Society cannot give any corporation or person the necessary power to carry on the business of supplying cities with potable water, but it can say it will permit a lawfully authorized party to take an agreed quantity of water, for any lawfully authorized purpose. The power to supply Newark, Jersey City or other places with water must be sought for elsewhere. It may possibly be found in some private charter, or in local or general legislation relating to the water supply of some particular city or place, or under general acts authorizing the formation of water companies, or giving cities power to secure water for use by contract with parties who may have water to dispose of.

In brief, I am of the opinion :

FIRST.—That you must find authority to supply Newark, Jersey City and other places in some legislative act or in some corporation formed or to be formed under New Jersey statutes.

SECOND.—That such power is not to be found in the charter of the Society for Establishing Useful Manufactures.

THIRD.—That the Society can make a contract under which it may lawfully bind itself to permit another corporation to take its surplus water for compensation; such other corporation having legislative authority to obtain water for some lawful purpose.

FOURTH.—That the power to deliver to Newark or any other place water obtained from sources now controlled by the Society will practically require pipes or aqueducts, and the power to take land for laying these pipes or constructing these aqueducts will undoubtedly require the exercise of the power of condemnation, which must be sought for in some act of the Legislature. There is no such power in the charter of the Society.

I am examining the other questions submitted to me. I should have been ready to report on them also, if my official duties had not occupied so much of my attention during the past week.

Yours truly,

LEON ABBETT.

OPINION OF HENRY C. PITNEY, ESQ.

MORRISTOWN, N. J., May 21st, 1886.

J. R. BARTLETT, ESQ.

DEAR SIR:

Yours of the 20th inst. received. The rights of the S. U. M. in the waters of the Passaic do not depend upon, and are not limited by the terms of their charter; it is idle to consult the terms of their charter in that connection.

The rights depend upon the fact that they are the owners of the bed and banks of the river; that is to say, they are what lawyers call "Riparian Proprietors," and have the right to have the water run in its natural manner without diversion.

The reason why they hold the key to the situation is, that in passing through their land, the river has a fall of seventy or eighty feet, which makes it valuable, and distinguishes their riparian right from that of riparian owners who have no available fall upon their land. It follows from the foregoing that the owners of the Little Falls water power, and of the Dundee water power have the same rights in the waters of the river that the S. U. M. has, except that the fall being less upon the lands of the Little Falls Company and the Dundee Company, their rights are less valuable. The S. U. M. have not the right against the other two companies named to divert the water and sell it in Newark and Jersey City. In order to do so they must condemn and acquire the right against Little Falls and Dundee.

But if a water company organized for the purpose of supplying those cities with water shall erect such reservoirs as will not only supply those cities in the summer time, but leave a surplus for the benefit of the water powers below, Little Falls and Dundee will get the benefit of it. The plan then would be and should be to arrange amicably with Little Falls and Dundee upon the basis of giving them the benefit of the reservoirs as an off-set to the diversion of water.

To repeat: in order to exactly comprehend the situation, imagine *A* owning Little Falls with forty feet fall, *B* owning Paterson, with eighty feet fall, and *C* owning Dundee with twenty feet fall, all three being mere private individuals with no chartered rights. Then suppose a water company organized to divert the water from above Little Falls goes to *A*, *B* and *C*, and proposes to make reservoirs large enough to store water enough in a dry time not only to supply those cities, but to leave a surplus for *A*, *B* and *C*. Now it is manifest that when this proposed water company has arranged with the owner of eighty feet fall, the butt end of its difficulty is disposed of.

Yours truly,

H. C. PITNEY.

OPINION OF HON. GARRET A. HOBART.

JOHN R. BARTLETT, Esq.

Paterson, N. J., May 24th, 1886.

MY DEAR SIR :

I am in receipt of your communication of this date, in which an answer is requested.

I think it will not be denied by any person acquainted with the general powers of the Society for Establishing Useful Manufactures, as derived from its charter, and from its natural riparian rights as land owners of the bed of the stream, and of the river banks of the Passaic River, but that it owns for its own purposes, without diminution or diversion all of the waters of the Passaic River, as they have been accustomed to flow over the Great Falls of the City of Paterson. At that point they divert and use all of this water, or so much of it as they chose to divert for the purpose of leasing same to millers, and receive for it under perpetual leases the rentals, of which you have full knowledge. Their right to take this water, and use it, and sell it, is as well fixed and well settled as law and custom and legal decisions can establish it. So well known, indeed, are those rights to all lawyers, mill owners, and users of water in our own City that they are never doubted or questioned.

So much for the general powers and ownership of the Passaic River at the Great Falls.

The answer therefore, to your first question is self-evident that the Society, being the owners, for their own purposes, under their general common law rights as riparian owners, as well as the powers particularly given by their charter and supplements, *of all the waters of the river*; that it is neither within the power of the municipal corporations of Jersey City, or of Newark, much less of any private water company, *to divert* a single drop of water from the Passaic water-shed "above Paterson and before it reaches the dam of the Society," without their assent. Such a proposition, or such a claim of right will not seriously be maintained by any lawyer in or out of New Jersey.

I answer the second branch of your first question, therefore, insisting that no such diversion can take place for any purpose *without the assent of that Society*, and the Society could at once enjoin by process of the Court of Chancery, any municipality or private water company, for such diversion without first having made compensation either by agreement, or by process of condemnation.

Referring to the power of condemnation on the part of any such municipality or water company, I beg to suggest for your information, that in all cases where the right of "Eminent Domain" is given, the first requirement of such law is that the owners of land, or of rights, or other interests sought to be taken, shall, if possible, first agree with

the authorities of the corporation seeking condemnation for the damage proposed to be done, and in case of failure to so agree, the condemnation clause takes effect : so that the Society would first have the opportunity to agree with any such corporation which desired the right to divert water at any point above Paterson.

I take it for granted, in answer to your third inquiry, that if the cities you name, have the legal right to supply their cities with water, with the power to obtain it, from whatever sources they can, that they have a right *to contract with any corporation*, or water owner, or owners who may have what they desire.

While, therefore, the Society has the power to prevent any one from taking their water, they have also the right to contract at the same time to permit the use of water, by those who may have by legislation the right to take it, for the purposes of supplying such cities as seek it. In other words, the Society has no right affirmatively to sell water to Newark or Jersey City ; but Newark or Jersey City, by its own legislative powers, in reference to the supply of water, can legally contract with the Society to permit the diversion so far as such diversion will not interfere with existing rights of tenants of the Society, whose contracts must be inviolate.

The Society of itself, in order to improve its own water power, to maintain and perpetuate its own contracts under its charter, could store water without limit, and agree that that surplus water not needed for its corporate purposes, should be diverted for the public use to any public corporation which has a right to take it under the law.

I think I have made the whole subject clear when I state that no power can divert from the Society the waters of the Passaic water-shed, or any portion of them, without the assent of that Society, or without the fullest compensation for all damages, present or prospective.

Yours very truly,

GARRET A. HOBART.

OPINION OF A. Q. KEASBEY, ESQ.

Newark, N. J., May 23, 1886.

J. R. BARTLETT Esq.,

DEAR SIR:

In your letter of May 22d, you ask me three questions:

1. "Has any municipality or private water company the right to take or divert
"any of the waters which would flow from the Great Falls at Paterson, without the assent
"of the Society for Establishing Useful Manufactures?"

This I answer in the negative. Without referring in detail to the terms of the ancient charter of the Society, or to the decisions defining the extent of its rights, it is enough to say that Chancellor Green, in the case of *The Society for Establishing Useful Manufactures, vs. Low* (2, C. E. Green 19) says—

"The title of the complainants, under their charter, to the waters of the Passaic River, for the purposes to which it is applied by them, has been too often recognized by
"this Court and is too firmly established to be treated as an open question."

If the rights of the Society to these waters are thus definite and complete, it is manifest that no municipality, or private water company, can invade them by any taking or diversion.

2. "Would the Society have a right to enjoin, by process in the Court of Chancery,
"any municipality or private water company from such diversion without having made
"compensation either by agreement or by process of condemnation?"

The reply to the former question answers this. Having a right to the waters for the purposes of their charter, the Society could protect that right from invasion by the ordinary legal processes; and an injunction in Equity is the ordinary and appropriate means of such protection.

3. "Taking it for granted the municipalities referred to, or the private water
"companies have the right to agree with persons who own or control water or water rights,
"has the Society, under its general powers, the right to contract with such cities or any
"such water company for the diversion which may be proposed, provided that such
"diversion be of surplus waters only—that is of those waters not needed for the corporate
"purposes of the Society?"

I think there can be no doubt that the Society has such right to dispose of its surplus waters to any extent which will not impair its power to accomplish fully the proper purposes of its charter. It is incident to those purposes that such a surplus should exist. In preparation for constantly extending operations, it must gather in the water supply under

its control, and accumulate it in reservoirs. It will have the same power to dispose of an over-supply, as of the ice that forms on the reservoirs, or of any power, materials or facilities otherwise lawfully acquired, and not needed for present use.

In the Morris Canal case (Saxton 157) it was urged that by increasing its water power and multiplying seats for manufacturing establishments, and by granting leases to individuals and private companies, the Society had abused its corporate powers.

But the Court held otherwise and said—

“A right to improve their estate, or to sell, lease, or otherwise dispose of their property, is incident to all corporations, unless restrained by the provisions of their charter; and the Society, as the proprietor of the lands had a clear right, without the grant of “an express power for the purpose, to have done all those things.”

If the Society in the course of its lawful operations, upon any scale it may choose to adopt, shall find itself possessed of surplus waters, it may dispose of them to such individuals or corporations as may be capable of contracting to purchase and use them, to any extent which will not impair its own corporate functions, or reduce the normal flow of the stream to the detriment of other riparian owners.

Yours truly,

A. Q. KEASBEY.

OPINION OF WM. PENNINGTON, ESQ.

PATERSON, N. J., May 24th, 1886.

MY DEAR SIR :

As counsel of the Society for Establishing Useful Manufactures, I beg leave to reply to your letter of the twenty-second instant, addressed to me in that capacity.

The ownership and rights of the Society to all the water of the Passaic River are established by its charter and titles, and by nearly a century of uninterrupted, continuous actual use and enjoyment.

They have never been successfully attacked, but on the contrary, have been confirmed when attacked, by authoritative decisions of the highest courts in the State.

In reply to your first inquiry, there can be no doubt in the mind of any lawyer that neither any municipality nor any private water company can have the right to take or divert any of the waters which would flow over the Great Falls at Paterson without the assent of the Society, or proper condemnation under the law of eminent domain.

In reply to your second inquiry, there is no doubt that upon a proper case being presented to the Court of Chancery of New Jersey, that court would issue its injunction restraining any municipality or private water company from such diversion.

In reply to your third inquiry, I beg leave to state that the Society, by the express language of its charter, has the right to acquire, hold and enjoy, sell, demise and dispose of property and rights "of what kind or quality soever," and can therefore either affirmatively, dispose of its rights to "the whole of the waters of the Passaic" (using the words of the late Chancellor Benjamin Williamson) or can, negatively, release its right to restrain the diversion thereof.

The right to sell and dispose is, in my opinion, an invariable elementary concomitant of ownership, and has no reference to the other special functions of a corporation.

There may, however, in all cases be objections aliunde to the right to convey or contract even, when, as in this case, the right and ownership are unquestionable. For instance, if "A," owning a house and lot in fee should contract to sell them to "B," and afterwards contracts to sell them to "C," "B" could restrain the sale to "C," not because "A" has not the right to sell, but because he has already sold and exhausted his power. Similarly the Society cannot dispose of its rights to the waters of the Passaic River in such a way as to prejudice its prior contracts or leases for water.

But I understand your question to refer to its right to agree to a diversion only of water not needed for the supply of its existing contracts, and on that understanding of your question I have no hesitation in answering your third inquiry affirmatively.

TO JOHN R. BARTLETT, ESQ.

WILLIAM PENNINGTON.

OPINION OF HENRY C. ANDREWS, ESQ.

JOHN R. BARTLETT, Esq.,

Dear Sir:

You ask my opinion as to the rights of the "Society for Establishing Useful Manufactures" in the water of the Passaic River at Great Falls, and as to the effect of this right upon other persons seeking to divert water from the Passaic River and its tributaries above the Great Falls, whether such diversion be made in New York or in New Jersey.

The rights of the Society may be stated as having a three fold source:

First, as derived from the ownership of the bed and banks of the Passaic River at Great Falls.

Second, as derived from its charter, and

Third, as derived from long undisputed, uninterrupted use, or prescription as it is called.

It's right as a riparian owner of the bed and banks of the Passaic River at Great Falls is one derived from the common law, and is that the Society is entitled to have the entire flow of the Passaic River and its tributaries pass through the natural channel of the river at Great Falls without diminution or diversion.

It is needless to cite any authorities in support of this right as it is as old as common law itself, and indeed anciently found expression in the maxim "*aqua currit et debet currere ut curere solebat.*" In the absence, then, of any other matter tending to diminish this right, the Society has, as above stated, the right to the entire flow of the Passaic River and its tributaries over the Great Falls without diversion or diminution.

The courts have frequently construed the charter of the Society in order to determine its rights, and in so doing have given weight to the objects for and circumstances under which the Society was incorporated.

In January 1790 the House of Representatives adopted a resolution requesting Alexander Hamilton, as Secretary of the Treasury, to report as to the means of promoting such manufactures as would tend to render the United States independent of foreign nations, and on the 5th of December, 1791, he submitted his famous report "on manufactures" which is still regarded as one of the ablest treatises on the subject of protection or encouragement of manufactures by the government ever written. His practical mind was not content with mere theories, and during that same year he drew up the charter of the Society for Establishing Useful Manufactures, which as far as possible was designed to be a practical embodiment of the matters contained in his report, and on the 22nd of November, 1791, this charter was enacted into a law by the Legislature of the State of New Jersey. It was designed to be "a national manufactory," and it was hoped that

there would grow up at its seat a great city that would supply the whole country with manufactures. The national character of the enterprise is strikingly shown in the provisions of the charter, permitting the United States and the several States to become subscribers to, and holders of its capital stock ; but Section X of the Charter wisely provided that neither the United States, nor any State, which may become a subscriber, shall be entitled to more than one hundred votes.

This public character has been fully recognized by the highest Court in the State. In *Society v. Butler*, 1 Beasley, p. 498, the Court of Errors and Appeals say at p. 504:—

“The Society for Establishing Useful Manufactures is not a new private corporation for purely private purposes. Its *quasi* public character appears everywhere upon the face of its charter. The act of incorporation is a public act. It was granted because it appeared to the legislature that it would be for the public interest. The sovereign right of eminent domain was called into exercise to accomplish its purpose. It looked to the creation of a city and to the collection and support of a large and valuable population of industrious operatives, who should add to the wealth and power of the state. That end has been accomplished. The city has been created ; that population has been collected ; employment has been furnished to a large and industrious population, who are now mainly dependent upon the water power there created, not only for their prosperity, but for employment and the means of subsistence. The character of a public use is thus clearly impressed upon this water, and the power which it creates.

“The society are not a mere private corporation controlling that power solely for their private interests. They are, to some extent, trustees of the power for great public purposes, and are bound to husband and use that power so as to promote the common interest of all who use it. They must indeed, as proprietors, of necessity have the control of the power, subject to the contracts into which they have entered, and a discretion as to the mode of employing and regulating it, but so as to subserve the common interest of all who use it, and consequently of all who are dependent upon it.”

The Great Falls of the Passaic were fixed upon as the principal seat of the factory on account of the purity of the water and the large amount of water power furnished at the Falls. The Society bought 700 acres including the bed and banks of the river both above and below the Great Falls, in the year 1792, and in the following year erected mills and built the first canal, which was followed in 1807 by the second canal, and in 1827 by the third. From the year 1796 until after the close of the war of 1812 the affairs of the company were in an unsatisfactory condition, and for this period the operations of the Society were practically suspended, except the making of some few water leases and the sale of some land. After the year 1814 the Society virtually ceased manufacturing in its own behalf and confined its operations to the leasing of water to other manufacturers, but in this way it has up to the present date utilized the full flow of the Passaic River during the season of drought, at which time that flow is scarcely sufficient to meet the requirements of its leases.

As soon as this change was made the Society became involved in litigation, in which the right of the Society to lease the water, instead of using it for its own manufacturing purposes, was vigorously contested, and fully sustained.

Society *vs.* Canal, Saxton 157.

Society *vs.* Low, 2 C. E. Green 19.

Society *vs.* Canal, 3 Stewart 145

On December 31, 1824, the Morris Canal and Banking Company was incorporated. This is the only corporation or person that has succeeded in any degree in encroaching upon the rights of the Society to the entire flow of the river. The building of the canal was begun in 1825, continued to Paterson in 1826, and to Newark in 1828, and since that year until the present there has been no time at which there have not been one or more suits pending between the two companies. The first action was begun in 1828 by the Society against the canal for diverting into the canal the water of some of the tributaries of the Passaic. The canal answered by saying that the Society was not harmed by its action, as the canal brought from Lake Hopatecong (in the Delaware Water-shed and outside the Passaic Water-shed) more water into the river than it took out. This being so, the court held (3 Stewart, p. 145,) that the Society, though undoubtedly entitled to all the flow of the river, was not harmed to an extent to warrant the Court of Chancery in enjoining the operation of the canal, but held (*id.* p. 160).

"I consider it, therefore, as clear, that the Society has a right, as riparian owners, to the flow of the whole of the waters of the Passaic River, in their ancient channel, down to the great falls; and the Morris Canal and Banking Company cannot divert the waters of the Rockaway, by which the waters of the Passaic at the great falls will be diminished, without encroaching upon the rights of the society."

Again at page 167.

"In my opinion, then, the society has, by their purchase and occupancy, acquired under and by virtue of their charter, a right to the use of the whole of the waters of the Passaic, at and above the great falls; and the Morris Canal and Banking Company has no authority or right, by their charter, to encroach on the rights of the society, by diverting the waters of the Rockaway, which is a principal branch of the Passaic, or in any other way by which there will be a *diminution* of the quantity of the water at the great falls."

Again at page 170.

"This is a particular case, attended with special circumstances, and where no *actual injury* has been sustained, but only danger apprehended. The defendants must, therefore, be left to proceed at their peril."

And in Society *v.* Canal, Saxton, p. 157, the Chancellor said:

"The rights (of the Canal), whatever they may be, are subject to the prior rights of the Society for Establishing Useful Manufactures, and must be exercised in such a manner as that the Society thereby sustains no injury. And, in fact, I understand this principle to be conceded. It was candidly stated in the argument by the counsel for the Company, that if in their future operations it became manifest that the Society was injured, the Company must either agree with them for the use of the water, or abandon their work."

The suit last cited was brought in 1830 by the Society against the Canal for diversion of water and the Canal made the same answer that they put as much water into the river as they took out. The case is reported in Saxton, p. 157, and at page 186 the Chancellor says:

"The charter granted the Society for Establishing Useful Manufactures was exceedingly liberal. It was intended to promote a great national object, and well calculated to afford extensive protection to exertion to enterprise. It was created in perpetuity and the ordinary and natural effect of non-user was expressly provided against."

And again at page 187.

"The Society at the place selected as the seat of their manufactories, own the land on both sides of the river and have had the possession for many years. They are the riparian proprietors, and upon plain and acknowledged common law principles they are entitled to the use of the stream. They have in it a property growing out of the ownership of the soil, which is oftentimes of more value than the soil itself and at all times as sacredly regarded by the law. * * * * * The right is not confined to the use of so much water as may be necessary for their present purposes, they have appropriated to themselves the use of the stream. They have a right to take out the whole of it for the purpose of their manufactories provided it is again, after being used, restored to the bed of the river for the benefit of those below, and provided also that no one having prior rights is thereby injured. Such I take to be the common law rights of the Society, independent of any additional privileges that may be secured to them by their charter."

And again at page 193.

"The case presented is peculiar; but it does not satisfy me of that pressing necessity or that certainty of mischief which would authorize an interference in a matter of such magnitude. * * * * * But the defendants must remember that they proceed upon their own responsibility and at their peril; if there be any hazard or any danger it is theirs to encounter and overcome it. The rights of the Society are clear, vested, and prior rights and the enjoyment of them in their full extent will be secured."

The injunction was refused solely on the ground that inasmuch as the Canal put in as much water as they took out, the Society as a matter of fact was not harmed.

In 1836 the Canal, wishing to obtain some legislation, made a truce with the Society, which took the form of an agreement in writing which attempted to define the rights of the parties. This agreement, however, has since been repudiated by both parties and may be considered as rescinded.

In 1845, the Canal brought suit against the Society for tearing down a certain water way which permitted water to flow from the Canal into the river, but this suit apparently never proceeded to judgment.

In 1847 and in 1853, the Society brought action against the Canal for damages for diversion of water, but they were not pressed to judgment.

In 1876, however, and in 1877 the Society brought two more actions against the Canal for damages for diversion of water, and then the Canal brought, in 1878, a suit in Equity to restrain the prosecution of these and other similar actions. The Society contested the right of the Canal to enjoin these actions on the ground, that the rights of the Society as defined by the courts are clear, and that the defense the Canal might have could be set up in such actions. But the Court held that the relation of the parties had been so complex for many years that it might be regarded that the Canal had acquired some rights which, while not available to them in a court of law, might be in a court of equity, and sustained the suit. The suit, however, was never pressed to a decree, and is

still pending; so that as between the Society and the Canal it may be said that the extent to which the Canal has encroached upon the rights of the Society, if at all, is as yet undetermined.

A portion of the Passaic water-shed lies in the counties of Orange and Rockland in the State of New York, being drained by the Ringwood, Wanaque and Ramapo rivers, tributaries of the Passaic, and which flow into it at Pompton, above the Great Falls at Paterson. It is important, therefore, to consider what are the rights of the Society under the law of New York.

The rights of riparian owners are thus stated by Chief Justice Savage in *Arnold v. Foote*, 12 Wend. 330:

"The doctrine of the common law in respect to the use of running waters is no where better expressed than by Chancellor Kent, in his commentaries (3 Kent, 439). Every proprietor of lands on the banks of a river has an equal right to the use of the water, as it flows in the stream, as it was wont to run without diminution or alteration. No proprietor has a right to use the water to the prejudice of other proprietors above or below him. He has no property in the water itself, but a simple usufruct while it passes along. He may use the water as it runs in its natural channel, but he cannot unreasonably detain it, or give it another direction. He cannot divert or diminish the quantity of water which would otherwise descend to the proprietors below, nor throw the water back upon the proprietors above."

These principles have never been questioned in New York and have been frequently reaffirmed by the Court of Appeals.

Not only is a person so diverting water from a running stream liable in damages, but in New York the Courts will interfere by injunction to prevent such diversion.

In *Hammond v. Fuller* 1 Paige, p. 197, it was held that where a party by erecting a dam raises a stream of water above its natural level, so as materially to injure mills above on the same stream, a Court of Chancery will decree that the dam be lowered, and that the party erecting the same pay all the damages occasioned by raising the water above its natural level.

In *Corning v. Troy Iron Nail Factory*, 40 N. Y., 191 decided in 1869, defendant had built a dam which diverted a portion of the water at Wynant's Kill at Troy, and had used it for several years. A mandatory injunction was issued directing the removal of this dam. On appeal the Court of Appeals say at p. 206:

"Upon established principles this is a proper case of equity jurisdiction. First, upon the ground that the remedy at law is inadequate. The plaintiffs are entitled to the flow of the stream in its natural channel. Legal remedies cannot restore it to them and secure them in the enjoyment of it. Hence the duty of a Court of Equity to interpose for the accomplishment of that result. A further ground requiring the interposition of equity is to avoid multiplicity of actions. If equity refuses its aid the only remedy of the plaintiffs, whose rights have been established, will be to commence suits from day to day, and thus endeavor to make it for the interest of the defendant to do justice by restoring the stream to its channel. If the plaintiffs have no other means of recovering their rights, there is a great defect in jurisprudence. But there is no such defect. The right of the plaintiffs to the equitable relief sought, is established by authority as well as principle. (*Webb v. The Portland Manufacturing Co.*, 3

Sumner, 190, and cases cited; *Tyler v. Wilkinson*, 4 Mason, 400; *Townsend v. McDonald*, 2 Kernan, 381; 2 Story's Equity, §§ 901, 926-7; Angell on Water Courses, §§ 449-50.)

These cases were approved and followed in 1882 in *Rothery v. N. Y. Rubber Co* 90 N. Y. p. 30. The Court say:

"It having been determined that the erection and maintenance of the dam at its present height was unauthorized and an invasion of the plaintiff's rights, the Court was authorized to render a mandatory judgment, requiring the defendants to lower the dam."

And in *Garwood v. N. Y. Cent. & H. R. R. Co.*, 83 N. Y., 400, the Court enjoined the defendant from diminishing the flow of the Tonawanda Creek above the plaintiff's mills, by supplying its locomotives with water.

The rule in the United States Court is the same.

Cove Silver Mining Co. v. Virginia, &c., Co. 1 Sawyer, 470.

Webb v. Portland Man'g Co., 3. Sumner, 189.

Atchison v. Peterson, 20 Wallace, 507.

Upon these principles the Courts would certainly prevent by injunction any threatened diversion of the waters of the tributaries of the Passaic.

Nor can the State itself authorize, by legislation or otherwise, such diversion without due compensation being first made. In 1873, the Legislature of New York passed an act which purported to give to the City of Rochester the waters of Hemlock and Canadiee lakes for the supply of that city. The plaintiffs, owners of mills on Honeoye creek, flowing out of Hemlock lake, brought an action for an injunction restraining the city from diverting the water of that lake. The Court of Appeals, in granting the injunction, say, (*Smith v. City of Rochester*, 92, N. Y. 463):

"Plaintiff's right to maintain an action to restrain the infringement of any rights of property which they possess as riparian owners is unquestionable."

And again at page 484, speaking of the power of the legislature to grant such right, the Court say:

"In *Commissioners v. Kempshall*, Senator Verplanck says: 'I cannot assent to the position that the conceded common-law authority of the State over such rivers, for the purposes of navigation, comprehends the right to divert the waters to other purposes of artificial navigation, wholly distinct from that of the river itself.' He then proceeds to state rules in apt and pertinent language, which we consider decisive of this case in its various aspects. 'The proprietor of the bed and bank of the stream has himself no absolute property in the waters, but strictly a usufructuary interest appurtenant to his freehold. He can use the waters for his own benefit; but he may not divert them to the injury of his neighbors, or lessen their quantity, or detain them unreasonably. If such be the strict limitation of the proprietary right, can it be that the State as the trustee of a special public servitude, has a much less restricted right, and can divert or detain the waters for other uses? By its sovereign right of eminent domain, it undoubtedly may do so,' * * * * 'but all these exercises of sovereign authority are alike, 'the taking of private property for public use,' which the Constitution pronounces may not be done 'without just compensation.'"

It is said by the court in *Ex parte Jennings*, that 'individual property cannot be taken, or which is the same thing, individual rights impaired for the benefit of the public without just compensation.'"

'The public right is one of passage and nothing more, as in a common highway. It is called by the cases an easement, and the proprietor of the adjoining land has a right to use the land and water of the river in any way not inconsistent with this easement. If he make any erection rendering the passage of boats, etc., inconvenient or unsafe, he is guilty of a nuisance, and this is the only restriction which the law imposes upon him. It follows that neither the State nor any individual have a right to divert the stream, or render it less useful or valuable to the owner of the soil.'

It was also said by Judge Earl in the *Chenango Bridge Case*, *supra* : 'The legislature, except under the power of eminent domain, upon making compensation, can interfere with such streams only for the purpose of regulating, preserving and protecting the public easement. Further than that it has no more power over the fresh water streams than over other private property.' (See, also, *Morgan v. King*, 35 N. Y. 457; *Hooker v. Cummings*, 20 Johns. 99; *Gardner v. Village of Newburgh*, *supra*.)"

It follows from these principles that the property in water from being usufructuary merely may be expanded into complete ownership by prescription against, or purchase from, inferior riparian owners; as for example in the case above cited, (*Society v. Canal*, 5 Stewart, p. 329), the Court held that if the facts should appear as claimed by the Canal, it acquired, by prescription alone, the right to divert waters from Pompton, and convey them through the Canal into New York harbor. Water thus acquired becomes like any other species of private property, as petroleum oil, for example, (*Kier v. Peterson*, 41 Penn, 357), and can be disposed of in any lawful way the owner chooses. If one should in this manner acquire the waters flowing in Orange and Rockland counties in New York State and should desire to transmit such waters through the State of New Jersey, and deliver them by tunnel or otherwise to the City of New York, this would in my opinion, be "commerce between the States," and would not be subject to regulation by any State, but only by the Congress of the United States. Thus in *Carson River Lumbering Co. v. Patterson*, 33 Cal., 334, it was held that a statute imposing a tax on logs cut in California and floated into the State of Nevada was void; Congress alone has power to regulate commerce between the States, and this includes the commerce of corporations (*Paul v. Virginia*, 8 Wallace, 169); so in *R. R. Co. v. Husen*, 5 Otto, 465, the Supreme Court of the United States held that a law of Missouri, excluding from the State during two-thirds of the year any cattle coming from another state, is void for the same reason.

The Society having the right to the entire flow of the river and tributaries at the Great Falls, has as incident to that right the power to allow, as far as it is concerned, another to divert a portion of that flow from above the Falls.

In conclusion, the rights of the Society are, in my opinion:

- I. As against all the world except the Canal, to have the entire flow of the Passaic and its tributaries pass at Great Falls.
- II. As against the Canal to have such entire flow so pass, with the exception of such rights as the Canal may have required, if any, and which rights and their extent are as yet uncertain and can only be determined by litigation or agreement.
- III. To dispose to any person or corporation of its interest in such surplus flow as it does not need for the purposes of its incorporation or to fulfill its contracts.

Yours very truly,

HENRY C. ANDREWS.



SPLIT ROCK LAKE.

Situated in Morris County, New Jersey; elevation above sea level 820 feet; outlet flows into the Rockaway River, tributary to the Passaic.

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ADDRESS BEFORE THE
BOARD OF MANAGERS
OF
THE NEW YORK PRODUCE EXCHANGE,
DELIVERED NOVEMBER 14, 1887.
BY J. R. BARTLETT.

PRESIDENT A. E. ORR: (Presiding.)

Gentlemen:—Mr. Bartlett is here by invitation of the Board to explain his plans for the delivery to this City of an independent supply of water. I will introduce him to you without further remarks.

Mr. Bartlett will kindly give us the information desired for the information of the Board.

Mr. Bartlett then spoke as follows:

Mr. President and Gentlemen:—In addressing you on this question of an additional and independent supply of water to New York City, I desire to mention a few facts touching the early history of New York showing the condition of its water supply at the beginning of this century, and to recall to your minds the events subsequent to the great fire of 1835, that the experience of this city following that destructive conflagration may be applied to our advantage at the present time and not forgotten, as is too often the case in the hurry of business life.

In 1800–5 the population of New York City was about 60,000; they were getting nearly all the water then used from wells. The Manhattan Water Company was organized with banking privileges to supply the constantly increasing demand for more water, occasioned by the city's growth; they built a reservoir on Chambers street, then considered outside of the City. They pumped water from wells into this reservoir and distributed it through wooden logs with holes bored through their centres to carry the water. Some of these logs in a good state of preservation have recently been dug up on Broadway and Cortlandt Street this summer in making the excavation for electric wires.

In 1820–5 the population had largely increased and the supply from this source became insufficient and the quality bad; many people returned to the old wells and also

dug new ones. Loud complaints were made of the inadequacy of the supply of water. The more people the less water.

In 1830, the population of the City had reached 200,000; the demand for water increased daily; several plans were proposed to meet these requirements; one was to build an open canal from the Housatonic River, another to build an aqueduct from the Croton River, and still another to secure the needed supplies from the Passaic River in New Jersey. To all of these plans there were objections, because of the excessive cost and the engineering difficulties which seemed insurmountable; the result was that nothing was accomplished to save the City from impending destruction.

THE GREAT FIRE OF 1835.

A terrible lesson had to be learned. It was in the winter of 1835, a very cold night, the City covered with snow, that the cry of fire was heard ringing through the deserted streets. The fire department were promptly on hand, but the water supply was so insufficient that the small quantity available, with its feeble pressure, rendered it impossible to put out the fire; it soon got beyond control, burned all night and swept away nearly the entire business portion of the City; wiping out nearly seven hundred stores and residences. The next morning desolation and misery appeared on every hand. It has been often said that fire and famine go hand in hand; there was no exception in this case.

A committee of safety, consisting of 150 leading citizens, was organized the next morning to feed the hungry and look after the necessities of the hour. Before the day had ended every Insurance Company in the City failed. The estimated losses were \$20,000,000. A large number of leading mercantile and shipping firms went under, and before a year had expired a panic was in full sway and every bank in the state suspended payment by legislative permission; all of which was the direct result of an insufficient water supply. A feeling of consternation, owing to the perishing condition of the City, took possession of the public mind. The question of getting an ample supply of pure water was then fully considered; plenty of water at all hazards must be had, no matter what it cost; all questions of expediency were discarded. All plans proposed were considered; they selected the Croton watershed as the source of supply, because of its greater availability.

BUILDING THE FIRST CROTON AQUEDUCT.

The decade following the great fire was chiefly devoted in building the Croton Aqueduct. Water was turned into it from the Croton River in 1842. A celebration in honor of the great event was held which exceeded by far the famous celebration of the opening of the Erie Canal, in fact nothing like it had ever occurred before; no celebration in this City ever equalled it in the intensity of the feeling engendered; it was a great thanksgiving, as the citizens had known what it was to be without water in the hour of need. They had a procession some seven miles in length so we are told; and when it was moving, the fountains in the City Hall Park burst forth, seeming to the population like waters bursting from the ground. The general thanksgiving and enthusiasm was unbounded. This aqueduct gave the desired

relief, they thought it would supply the City's wants forever; they built it large and liberal for those days, but they did not foresee the marvelous growth that was to follow. Suffice it to say that only thirty years after, some fifteen years ago, the limit of the capacity of the great aqueduct which astonished our fathers and was the great wonder of the age that built it, was reached, and the cry again was heard—more water. The City had grown; its population had spread over all of Manhattan Island; and places which in the old days were occupied by farms, and considered out of town, had become in 1875, covered with streets and buildings almost to the Harlem River, and contained a population of a million of people. The City authorities again took up the question how to get more water.

It is a very interesting chapter in the history of this great subject, to note all the various schemes that have been proposed to meet the rapidly increasing demands of the City to supply its enormous population with pure water, in quantity sufficient to meet all requirements for sanitary, domestic and fire purposes. The city authorities wisely undertook to build a new Croton Aqueduct to increase the supply from the present source, the only real practical way open to them at that time to increase the supply.

This was several years ago, when the City's needs were not as great as now, that the new aqueduct was commenced. The old aqueduct now in use, which was built forty-five years ago, is taxed to its utmost capacity, and is wholly inadequate; the new aqueduct which it is hoped will be completed in two years, will be of inestimable value in relieving the old one from the dangerous burden it is now subjected to; but it will not increase the present inadequate supply, except during the storm months, until after the completion of the storage reservoirs at Sodom and of new pipe lines south of 135th Street.

QUAKER BRIDGE DAM.

These reservoirs and pipe lines will increase the supply somewhat, but not in sufficient quantity until after the Quaker Bridge Dam is built, which, we are informed, will be the largest structure of its kind in the world, and to some extent an experiment, the object being to impound the whole of the available rainfall of the Croton water-shed. It will take several years to build, and will cost several millions of dollars. Assuming that the Quaker Bridge Dam is to be built, it will be at least a great many years before a sufficient quantity of water to meet the demands of the City can be secured from that source, and even then it will not be delivered under such pressure as is required down town; and furthermore, the population of the City, above 42nd Street, will by that time require the whole of the minimum rainfall that can be impounded on the Croton water-shed by the proposed reservoirs.

I now desire to lay before you our work and plans, that have led to the solution of perhaps one of the most complex problems of our time, which, in view of the enormous population now centering here and its large yearly increase, has become the great necessity of the hour.

We took the question up originally for the purpose of ascertaining if an ample supply

of pure water could be procured for Jersey City and Newark, who are using water pumped from a tidal stream, containing the sewerage of a large population. We worked up stream, so to speak, first securing the legal and riparian rights necessary to divert water from above the Great Falls, to supply all the cities and towns in New Jersey lying south and east of the City of Paterson and the Orange Mountains. The solution of these questions enables us to take pure water from our own State, by letting it run in its natural channels through the State of New Jersey, until it reaches the point where we have the legal right to divert it from said channels, and convey it in suitable conduits to the great natural distributing reservoirs at the Great Notch in the Orange Mountains, having sufficient elevation to deliver the water into the top stories of the highest buildings in New York City. From these reservoirs, said water will flow in pipes to the Jersey City shore of the Hudson River.

PASSAGE OF THE HUDSON RIVER.

To cross the Hudson River safely, with such a large body of water, was really the hardest problem. Our engineers examined carefully into the system of laying large pipes on the bed of the river; but as the Hudson between New York and Jersey City is about one mile in width, and reaches a depth in places of sixty feet, with a four mile current, and the bed of the River is composed of soft material reaching from 30 to 100 feet in depth, the pipe line system was abandoned as not feasible for the purpose, as it could not be relied upon to be forever safe. A water supply to a great city should be constant and instantly ready for use at all times when wanted, day and night. I abandoned the pipe line scheme and interested myself in the old Hudson River Tunnel, which you are all more or less familiar with. I was convinced that if this tunnel could be built it would solve the question of the delivery of the large amount of water contemplated and insure its safe delivery for all time, as we could lay steel pipes in the tunnel that could be inspected daily their entire length, and be secure from accident and injury by malicious persons. To put ourselves in a position where we could say to you and to this City, we not only have the water required, but can deliver it in the manner proposed, so that it will be sure to the City and safe to ourselves to do the work, it became necessary to demonstrate the fact. I therefore pumped out the old tunnel and had it examined as to its structural strength; and to prove that it was feasible as affording a safe avenue to conduct the water through, and that it could be built, I proceeded with the work of construction until these facts were proven and have built the past summer over 300 feet of new tunnel on the end of the old one, completing in all about 1,800 feet from the Jersey City shore, which is more than one-third of the distance to New York.

What we propose to do is this; to take water from that portion of the Passaic watershed lying in Rockland and Orange Counties, in this State, a wooded mountainous region, adapted by nature to supply water in large quantity and of unexceptionable quality. This region is drained by the Ramapo and Wanaque rivers, whose waters flow southward

into the Passaic River; these waters from Rockland and Orange Counties will be stored in properly constructed reservoirs, on the channels of said rivers, thus preventing the stagnation and insuring purity of the water, because it will be in constant circulation.

From these reservoirs, the water will flow in its natural channel to the point selected by our engineers having the proper elevation to permit it to run by gravity to the Great Notch reservoir on the Orange Mountains. In this plan, all riparian rights are fully protected, all interstate questions avoided, as the water taken will flow from the State of New York, and will be in addition to the ample supply of pure water already secured and provided for all the cities and towns in New Jersey dependent upon the Passaic water-shed for their supply. Contracts have been already executed with the old Society, at Paterson, and with the Dundee Water Power and Land Company, in the City of Passaic, securing and permitting forever the diversion of a full supply of pure water from mountain sources from above the Great Falls to be supplied to the cities of Paterson, Passaic, the Township of Montclair and the cities of Newark and Jersey City and surrounding towns, even as far south as the sea.

Some objection was made in years past to the proposition to take water from the State of New Jersey to supply the City of New York; this objection would be good and valid provided the water so taken was required or would ever be required for the citizens of that State. We do not propose in our plans, you will notice, to take New Jersey water at all, but the water from the State of New York, through the State of New Jersey, conforming thereby to the laws of nature and to the laws of the State, which protects every citizen in the lawful use of his own property, and water is property. In this manner no one is wronged in any way, and this City is enabled to get what it needs from the territory of our own State cheaper and quicker than in any other way.

The Passaic water-shed is nearly 900 square miles in extent, located in both States; almost three times the size of the Croton water-shed. It has sufficient area, rainfall and storage reservoirs within the State of New Jersey to supply all the cities and towns tributary thereto, reserved for them, more than they will need; and sufficient to supply a population of 3,000,000 of people east of the Orange Mountains, where Newark, Jersey City, Montclair, the Oranges and other towns are located. This water-shed is not an agricultural country; it is sparsely settled, chiefly wooded, with many beautiful lakes, several of which we have already purchased as storage reservoirs; they are situated from 1,000 to 1,200 feet above tide water. Then, again, the cities and towns in New Jersey which require this water for their own use are as much interested in having New York City supplied and protected as we are, because thousands of the citizens of New Jersey do business in New York; they want both places protected, their places of business as well as their homes.

BENEFITS TO THE CITY.

The following are some of the benefits that will be secured for this city by the adoption of my plans:

It will enable the City to obtain the supply of water in the shortest possible time, delivered where most needed, i.e., in the lower part of the City, which is more exposed to danger and less protected because more remote from the present source of supply.

It will give the City a supply from a source entirely independent of the Croton water-shed, which will afford great protection to the whole City in the event of accident to, injury or destruction of the High Bridge, the old or new aqueduct, or the Quaker Bridge Dam (if it should be constructed). You are fully aware of the grave and serious results that would follow the cessation of the supply of water to this City for a single day, situated as it is on an island. Its continued prosperity depends more upon an ample and assured supply of pure water than upon any other one thing.

It will save the cost of building additional mains to the lower part of the City which will be required to meet the demands of the down-town districts, unless the independent supply now offered is secured.

The water will be of unexceptional quality, sufficient to meet all sanitary requirements and to promote the public health.

The water will be furnished under a continuous pressure that will force it above the tops of the highest buildings, and thus fill all the requirements of a complete water service, and enable the fire department to prevent large conflagrations. This result cannot be obtained from the Croton water-shed.

It will amply provide for a special fire service, which the City is authorized by law to build, and will furnish water under a high pressure available for instant use even on the tops of the highest buildings, thus affording the best fire service system of any city in the world.

It will enable the present pumping plants in private buildings to be dispensed with, effecting a great saving of expense to the owners.

There will be delivered into the top stories of the highest buildings an abundant supply of water for domestic, sanitary, manufacturing, and other uses, and the income of property owners, and consequently of the City, will be greatly increased by reason of the increased business.

The lower part of the City bounded by the North and East Rivers is being crowded more and more each year with an ever increasing business. A new city is building on top of the old one. The three or four story buildings of the past generation are now having four or five stories added to them, and even eight to ten, thus doubling the population within the city limits, and much more than quadrupling the value of property, and hence requiring a double supply of water under new conditions, to meet the new requirements.

The population of the upper or northern part of the City and suburbs contiguous thereto, beyond the Harlem River, must necessarily seek its supply of water from the Croton water-shed. That population is increasing with great rapidity, and all the water

that can be secured from the Croton water-shed will be needed to supply the territory named and that portion of the City above 42d street.

The supply we propose to furnish is not only required for the protection of health and property below 42d street, but in a broader sense for the protection of the whole City, in the event of military invasion by a hostile army or domestic violence, than an independent supply from an independent source far removed from the Croton water-shed would be of incalculable value, as shown by the very able reports of all the military authorities who have examined and approved my plans.

GROWTH OF NEW YORK.

I now wish to speak to you a moment about the population of this City and its wonderful growth, something unknown before in the history of any of the great cities of the world.

I have had an expert investigation made into this subject and find that the present population of the City proper, (that is within the corporate limits of the City) has reached the enormous figure of 1,600,000, and, within a radius of twenty miles from the City Hall, we have a population exceeding $3\frac{1}{2}$ millions; which is greater than the entire population of the thirteen original states at the time of the Declaration of Independence.

Chicago is often spoken of as showing wonderful growth, but the City of Brooklyn, one of our suburbs, contains more houses and more people than the whole City of Chicago embraces to-day. From the tower of this building, you can view the work-shops, offices and homes of more than five per cent. of the population of this continent. The increase on these figures will this year exceed one hundred thousand, and thereafter a still greater increase. The elevated roads are crowded to-day as the surface roads were twelve years ago—rapid transit is still unsolved; the population increases faster than the accommodations; we never build large enough. The result of this will be that all the water that can be procured from the Croton water-shed, even after the building of the Quaker Bridge Dam, will be required to supply the large territory and the rapidly increasing population between 42d Street and the Harlem River and beyond. I therefore say we need all the water we can get.

PRESIDENT ORR:—I do not think there can possibly be a doubt as to the efficacy of having two water supplies, and therefore I do not think there would be any objection from that standpoint; but we would like to be informed as to the cost, and how you propose to deliver this water; whether you will deliver it at so much per million gallons, or if you expect to have the city purchase your rights?

MR. BARTLETT:—We propose to deliver this water into New York City at a rate per million gallons, delivered under such pressure as may be required from 300 feet head down, and the City need not pay nor obligate itself to pay one dollar until after the water is actually delivered into the lower part of the City.

PRESIDENT ORR:—Mr. Bartlett, have you figured the probable cost per million gallons?

MR. BARTLETT:—Yes, Mr. President, I have; but it is impossible at present to fix, (except approximately) the least price at which the water can be delivered. The City is authorized by law to pay a price, per million gallons, equal to the cost of the Croton water to this city during the year 1882. Various estimates have been made as to what that cost is, they run from \$64 per million gallons the minimum, to \$90 as a maximum. It depends upon the amount of interest included and the amount of repairs required in each year. It is a difficult thing to get at just what it costs the City, but the water can be delivered, I think, for about \$60 per million gallons based upon a plant of 50,000,000 gallons daily capacity.

PRESIDENT ORR:—Mr. Bartlett, let me ask you there—You say you can deliver it, you think, at about \$60 per million gallons, at a 300 feet pressure, but would it not be necessary to repipe the whole district where this water would be used?

MR. BARTLETT:—Yes, Mr. President, I think it would in part only.

PRESIDENT ORR:—Will the City have to do that?

MR. BARTLETT:—Certainly, the City would have to do it. Let us look this whole subject squarely in the face. I have stated, the city at this moment is in a condition, as far as its water supply is concerned, as dangerous as it was previous to the fire of 1835.

THE FIRE DEPARTMENT CALLING FOR MORE WATER.

The fire department have been informing us in their reports for years that the pipes in the down-town districts are too small. They cannot get sufficient water at fires, giving as a reason the insufficient pressure or quantity. Part of the present system of pipes in our streets down-town, was laid forty to fifty years ago, and as the life of an ordinary plant is about thirty years, it is not surprising or strange that the present plant should be insufficient for the demand upon it. They are too small, and in many cases will have to be replaced.

In the report of the Fire Department for the year 1881, I find the following:

“Notwithstanding the continued improvements made by the Department of Public Works, in laying larger mains and placing additional fire hydrants thereon, as well as upon those already laid, on the recommendation of this department, the necessary water facilities for purposes of fire extinguishing are often wanting. A notable instance of this occurred at a fire on February 3d, at No. 329 Bowery, where it was found that the water would not flow from the hydrants in the vicinity, although they were directly connected with a 36 inch main, and at the same time, the water did not rise above the outlets in the basement of the quarters of one of the Companies of the Department, located in the same section. This condition was assumed to be due somewhat to the extraordinary consumption of water during a period of very cold weather, then prevailing, which also of itself very much increased the danger of fire; and this instance is cited to show the serious disadvantage, resulting from an inadequate supply of water, under which the department frequently labors, and the imperative necessity for empowering the proper officials of the City Government to promptly meet the requisitions made from time to time

The \$60 per million gallons referred to as the approximate cost was based upon the partial estimates of quantities received at that time. Later reports from our engineers and the cities to be supplied show that, after the wants of Newark, Jersey City and the other municipalities in New Jersey are secured to them, it will be necessary to build larger reservoirs and aqueducts and also tunnels not before included under the Hackensack and Passaic rivers, now deemed necessary to insure absolute safety to the works and permanence to the flow of water to the Cities of New York and Brooklyn from that portion of the surplus waters reserved for their needs. The total cost, however, to the City of New York delivered will not exceed \$80 per million gallons—it may be less.

by this department to supply this want. During a period of seventy-two days of drought, and especially towards its close, in October, the Department of Public Works found it necessary to decrease the outflow from the distributing reservoirs to such an extent, that the arrangements made some years ago for signaling for an increased pressure by telegraphing to the Gate House in Central Park, had to be frequently resorted to at fires."

Later, the next year, Mr. President, the Fire Department reported as follows on page 52:

"The water supply was found to be inadequate, the signal for increased pressure having been sent at 10.41 A. M., and for its discontinuance at 12.40 P. M."

Again in the same year on page 54, they say:

"That these fires, occurring in such dangerous proximity, both as to time and location, and taxing the energies of the force to an unprecedented degree, were successfully extinguished, was a gratifying evidence of the efficiency and reliability of the organization, as well as of its ability to cope with fire under even such extraordinary circumstances. But it also served to emphasize the belief in the possibility of fires breaking out under circumstances so adverse (as for instance the occurrence of a number of large fires in the lower part of the City at the same time—as in this instance—combined with a deficient water supply, very high winds, and streets rendered almost impassable by snow), as to make it doubtful whether the present organization could avert disastrous conflagration."

In the same year on page 238 they report:

"The amount of water used for fire extinguishing purposes during the year is estimated at 47,418,250 gallons inclusive of the water drawn from the rivers. At several of the larger fires, notably those in the Potter Building, on January 31st, and Hecker's Mills, July 31st, the water supply was very deficient."

PRESIDENT ORR:—That was the annual drain for fire supply? The estimated amount is only 47 million gallons per year; which is equal to only one-half day's output of the daily supply from our present water system, which I understand is about 100,000,000 gallons.

MR. BARTLETT:—The daily consumption of the whole City now exceeds 100,000,000 gallons, and is increasing. The amount of water actually used by the Fire Department in putting out fires each year is, of course, but a small part of the whole amount required for other uses; as shown by the reports, the annual quantity used in the extinguishment of ordinary fires does not exceed one-half of the whole amount used by the City for general purposes in one day; the exact amount used for extinguishment of fires in that year was 47,418,250 gallons.

They again reported in 1886, on page 40, in reference to a fire in Elizabeth street:

"The water supply was very deficient, notwithstanding that an increased pressure was signaled for."

So it appears all the way through these reports of the department, they are continually asking for more water, and one of these days a fire will get beyond the control of the Fire Department. The situation is just as it was in 1835; it is true we have more water than we had then, but the City's needs are ten times greater, and the buildings are double the height; and if such a fire occurred now as in 1835, the loss instead of being \$20,000,000, as in the old days, would be nearer \$200,000,000.

The Fire Department again reported in 1886, on page 42.

"The water supply was entirely inadequate, a condition due to the smallness of the street mains in this section of the City, and to the fact that the fire in Corlears street had partly exhausted the supply."

In this case there happened to be two fires on the same day. Here it is very clear, one of the greatest dangers lies concealed; if two or more fires should occur at the same time, the fire would have undisputed sway, there would be actually no water available to put it out, and if the material it commenced to feed on should be of the highly inflammable kind, a destructive conflagration would be in full sway and get beyond control.

This past summer the same complaints were made, with which you are all undoubtedly familiar as you probably read the newspapers; on July 3 the following appeared in one of the dailies:

"Chief Shay looked with disgust on the feeble spouts of water coming from the engines working at top speed and bemoaned the inadequate water supply. Many of the firemen were worn out with the work of the previous twenty-four hours, and in their enfeebled condition could not resist the effect of the smoke in their usual manner. They were willing to work, but had but little water to work with."

PRESIDENT ORR:—I would like to ask this question, Mr. Bartlett. You say that you would deliver this water from your own source of supply, at a given point, in the lower wards of the City, for a certain price per million gallons. How much would you require the City to take—all that you can deliver?

MR. BARTLETT:—I have been informed, and from facts in my possession, believe that the City would require not less than fifty million gallons per day delivered as we propose. It certainly needs that amount of additional water available for its use at all times. That would be the minimum supply to start with; it would increase the cost per million gallons to take a much less quantity. The City certainly needs that quantity secured to it, and will need more in the future.

PRESIDENT ORR:—You would insist on the City taking at least that much?

MR. BARTLETT:—That would be entirely a question of price. If a less amount is fixed as the maximum supply, the price would be gauged accordingly, because the construction of the works has to be made to a fixed capacity corresponding to the amount to be delivered.

PRESIDENT ORR:—I understand the basis of your proposed contract to be 50,000,000 gallons per day, at \$60 per million gallons! That would be about \$1,100,000 per year, and according to the statement you have just read, the value of the water used for fire purposes at the same price is only \$2,820.00 per year.

MR. BARTLETT:—It is not a question of the cost of the water actually used to extinguish fires, which would be light; what we all, underwriters and merchants, want is that little shall be used for such purpose which would mean small fires, and consequently light losses. But the vital question is to have that small amount of water

instantly available when needed, and plenty behind it if wanted. In this way large fires will be impossible. The water should be instantly ready for use under pressure in masses to extinguish fires when they start; then and then only are we safe and disaster averted.

We are not planning to meet only the purposes or requirements of the fire service, that is only one of the uses for which the City needs water. Our plans are sufficiently comprehensive to embrace all the wants of the City, any one of which is important. It requires an ample supply of water for sanitary purposes, for the comfort and health of the people; it requires large quantities of water for domestic uses and for manufacturing purposes; it will be, as stated, of great and special value to the City for the extinguishment of fires, because it will be delivered under pressure, and always available for that purpose.

PRESIDENT ORR:—Is it your purpose to construct your works now, so as to include New York, or would you require the City first to give you a contract?

MR. BARTLETT:—It would be necessary, in making a contract, that the amount required by the contracting parties be mentioned to enable the capacity of the works and the cost of the water to be determined. The City must contract to receive and pay for it, if we agree to deliver it.

PRESIDENT ORR:—You will guarantee its delivery in a manner satisfactory to the City?

MR. BARTLETT:—Yes.

PRESIDENT ORR:—How long will it take to deliver it?

MR. BARTLETT:—About eighteen months. It will take twelve months to build the tunnel under the Hudson River. We have built enough of it already to determine that fact, if work is conducted at both ends and with full force.

While it is evident the needs of the City at present are great, they will be much greater, especially in the down-town district on completion of the works; and the water from the Croton water-shed will not be delivered under the pressure required by the needs of the lower part of the City, even when all the water available from that source is obtained.

MR. GEORGE MILMINE:—Now, that is a statement, Mr. Bartlett; are you clear on that point? Here is the lowest part of the City, of course the pressure is greater in the pipes than in Central Park; now, if there is an ample supply of water, and there are sufficient mains to bring it down to the lower end of the City, I don't see why we should not have a good pressure.

MR. BARTLETT:—I will tell you why. The height of Central Park Reservoir is 119 feet above tide water, which is not sufficient to send water to the height required in a great portion of the City. The drawing of water by users from the pipes all the way down to the battery, a distance of about six miles, greatly reduces the pressure at the lower end of the pipes. The peculiar formation of New York City being long and

narrow, is to some extent accountable for this, as it prevents the circulation or equalization of pressure throughout the system. What is wanted is an independent supply from an independent source, delivered at or near the lower end of the city. The Board of Engineers who have carefully examined my plans have so advised.

MR. MILMINE:—Now, I do think if we had an abundance of water to raise it 150 feet above tide, that there would be a lack of pressure, but it would flow to a level of 150 feet less the friction. If we had an abundance of water it can be pumped for fire purposes. Is that not so, Mr. Bartlett?

MR. BARTLETT:—Certainly, water can be pumped to a sufficient elevation to meet the requirements of the Fire Department, if kept under a constant head, sufficient to be instantly available for use in extinguishing fires, but it would be very costly, and would not furnish the water required under like pressure, for all purposes in the top of high buildings that an independent supply, from an independent source, under pressure would afford.

MR. MILMINE:—I think that is very well, but if we get water enough from the present source, as we are really expecting to get 350,000,000 gallons when the storage reservoirs are completed, on the whole, that ought, it seems to me, to give us plenty of water.

MR. BARTLETT:—That amount would give us plenty of water, but we cannot get that amount from the Croton water-shed. The greatest amount that can be impounded in the Croton water-shed during years of least flow would not equal anything like the amount you mention. Our population is growing with great rapidity, and we will need the whole of the water that can be obtained from the Croton water-shed, even after the Quaker Bridge Dam is built, to supply our City from its Northern boundary down to 42d Street. And furthermore, it must be considered that there will not be sufficient water from the Croton water shed for present wants, even when the new aqueduct is built, except during the storm months.

Please do not forget that the greatest strength of any structure is equal only to its weakest part, therefore you cannot count on a steady supply from the Croton water-shed exceeding its minimum production during one or two months in each year, or the dry season. When there is plenty of rain there is plenty of water, but that is during a limited time only, that such full capacity can be secured.

PRESIDENT ORR:—Well, is it not a fact, that after the Quaker Bridge Dam is built there will be an estimated daily supply to the City of New York, (that is taking into consideration the quantity that can be stored,) of 350,000,000 gallons?

MR. BARTLETT:—There will not be that quantity available for daily use, even after the Quaker Bridge Dam is built, but that dam is not built and cannot be built for several years. If we had the dam now, the quantity of water from the Croton water-shed would be sufficient for present uses; but we cannot build it for many years, and even then the water will not be delivered under pressure sufficient to meet all requirements.

PRESIDENT ORR:—Very well. Is it not a fact that they could obviate the lack of

pressure by running a separate main to the lower part of the City, thereby preserving the pressure up to the point where it is to be turned on? The difficulty now is that we have only one main, and they are all drawing from that, the many openings constantly reducing the pressure. Now, if they would run an independent main to take care of the lower portion of the City, say from the reservoir down, you would hold all your pressure, if there is the quantity of water to supply both mains?

MR. BARTLETT:—Yes, Mr. President, you would have the water after going to the great expense of laying such additional mains the length of the City, several miles, but not under pressure sufficient even then, and such water so delivered would be dependent on the present source for supply.

PRESIDENT ORR:—You would have the pressure of 120 feet, less the friction of the pipes, but you would do away with the existing trouble of absences of all pressure?

MR. BARTLETT:—That is correct, but only to the extent that the head pressure of the reservoir in Central Park, less the friction in the pipes through the length of the City, will deliver the water at its lower end, which would even then be entirely insufficient to send water to the top stories of the majority of buildings, and to afford water for extinguishment of large conflagrations, because, as before stated, the elevation at point of delivery of water from the Croton water-shed is too low to afford the protection needed without pumping, and this statement would hold true on the duplication of the mains to any extent.

There are other strong reasons why I advocate an independent supply in addition to those already given, viz: in consideration of the fact that it will take a great many years to build the Quaker Bridge Dam after it has been commenced, which has not yet been done, as there is much opposition to its construction, I think that the City should build it to utilize the full powers of the new aqueduct now building, and also secure all the water that can be had from the Croton water-shed. We will need it all; we cannot have *too* much water, in fact it will all be required when we get it, as the population in the upper districts will have grown up to the supply and will want every gallon.

MR. EDWARD H. DOUGHERTY:—Mr. Bartlett, do you propose to supply Jersey City, Newark and the City of Passaic?

MR. BARTLETT:—Yes, sir, that is part of our plans and embraced in the system myself and associates are creating, when the cities you name desire to change their present polluted supply for a pure one. We have been building the plant in the Township of Montclair the past summer, and have laid some twenty-five to thirty miles of pipe and hope to have water running through them next month.

MR. DOUGHERTY:—Taken from the mountains?

MR. BARTLETT:—It is the intention that water from the mountains shall be delivered to the Township of Montclair as soon as the large system of conduits, necessary to supply the larger cities is completed, but at present the supply for that town will be taken from large wells which we have constructed at Watchung, near the foot of the mountain,

carried down through the freestone to the water bearing strata, by the free use of the Diamond drill.

MR. MILMINE:—Do you propose to go on with this work in New Jersey whether the City of New York takes it or not?

MR. BARTLETT:—As far as construction of works in the State of New Jersey is concerned in the carrying out of contracts and obligations entered into there, most certainly. We are planning a water supply system for the benefit of the cities and towns east of the Orange mountains, which we have so far expended large sums of money in creating under the direction of competent hydraulic engineers and eminent legal counsel.

MR. MILMINE:—There is no question about the supply of water from your sources of supply?

MR. BARTLETT:—There is no question whatever about that. The extent of the water-shed is ample, and the quantity of water available, by construction of proper reservoirs, is sufficient to supply a population of 5,000,000 of people, and satisfy every want necessary to insure a higher standard of health in the community, and to afford in its fullest sense that protection to the vast insurance interests of the country represented to a very great extent by the New York Board of Fire Underwriters, who have fully considered all these questions and have passed favorably upon them.

EXTRA HAZARDOUS RISK CARRIED BY NEW YORK UNDERWRITERS.

That brings me to this question of insurance, and I wish here to speak of the Underwriters of this City, who stand between you and fire losses as a shield, guarding your property, your homes and your business from loss by fire. They ask the City to get more water to protect itself against disastrous conflagrations, that their risk of being extinguished themselves by such calamities as overtook Chicago and Boston, and even this City in 1835, may be prevented. The insurance companies require and deserve your full support in every proper measure looking to the greater protection of this City, and the risks from fire which they are underwriting for your benefit every day.

The Committee of New York Board of Fire Underwriters, before writing their report approving our plans, made a personal inspection of the Hudson River Tunnel; they went into it, even to the heading under the River, to satisfy themselves beyond all possible doubt it could be built, as the passage of the Hudson River has always been one of the greatest barriers to the introduction of an independent supply, but that obstacle will now fortunately be removed by the building of a tunnel to accommodate the large steel conduits or pipes that we propose to lay therein to deliver water into the heart of the "dry goods district," or any point selected down-town, for all purposes, public and private, under pressure, and in quantity sufficient and available in masses for the extinguishment of any fire that can be started. In this way, and in this way only, can such fires as visited this City in 1835, Chicago in 1870, and Boston in 1872, be averted. I was in the City of Boston that fatal Saturday night, and saw large and massive buildings deemed fire-proof melt away as the morning dew before the sun; and in 1835 the marble Exchange in this

City, also deemed fire-proof, and in which was stored valuable documents and property that could not be replaced, was wiped out of existence.

If a fire should now or hereafter get beyond control of the fire department the results will be appalling. It would be a calamity not only to the city but to the nation unequalled in the history of this country. We have in the vast teeming population now centering here a new factor never before considered which has become a source of much apprehension and serious thought, to popular government a menace, to our city a threat. I refer to the procession of anarchists which took place on Fifth Avenue a few days ago, carrying the red flag of revolution, the enemy of our laws, our cities and our civilization, whose avowed weapons are the bomb and torch.

Not only do I advocate the necessity of obtaining more water, but above all the procurement of an independent supply from an independent source, so that the City will be safe from an attack on its present source of supply by either a hostile force, or revolutionary crank; and when you consider that 100,000 people are being added to this City every year, with an increasing ratio, you will see the need of an abundant water supply. What will the population be when the full storage capacity of the Croton water-shed is secured; such addition for the several years required to construct the necessary reservoirs added to the present population, will need it all. I wish to call your attention to all these things that you may think, and thinking, act, if in your judgment you believe I am right, and what I say is true, that the City needs an additional supply of water from an independent source, and that the same should be procured as quickly as possible to meet the city's needs.

MR. MILMINE:—At the same cost as the City gets it now?

MR. BARTLETT:—I would be very happy to furnish it at that price.

I will say but a few words more in conclusion unless some gentleman wishes to ask me more questions.

PRESIDENT ORR:—Mr. Bartlett, I am impressed with the confidence you express in your project. Would you consent to its test in this way; you have not limited the period for which you require a contract from the City of New York; would you be willing to make it optional with the City to terminate it at the end of ten years? It is evident that if your anticipations of the City's needs are correct, and that your method is the best and cheapest, it would not terminate the contract, but the question which I ask you is, would you give such an option?

MR. BARTLETT:—Yes, Mr. President, we would be quite willing to give such an option to the City as you suggest, for I am satisfied the City will be more likely to require more water at the end of ten years than to discontinue the use of this supply, and the advantages that will be secured by its delivery.

PRESIDENT ORR:—Mr. Bartlett will you kindly let us know what you expect of this Board—what you ask this Board to do?

MR. BARTLETT:—I ask this Board that the Produce Exchange, a representative body

of merchants and others interested in the prosperity, safety and credit of this City, interest themselves in this important subject and use their great influence in securing to this City for its health and protection an ample supply of water from an independent source. We do not ask you to assume any responsibility which you should not. I only desire that you ask the Sinking Fund Commissioners to examine my plans, and if found practicable, and that we can deliver the water, to contract for an adequate supply to fully meet the requirements of the City, especially the down-town districts. I think you will agree with me that there is no question about the urgent need for more water delivered as we have planned, as you will notice that some twenty of the leading firms in the City have petitioned the Sinking Fund Commissioners to see if a new and additional supply cannot be procured to afford better protection to the City. These firms are located chiefly in or near the "dry goods district," where the danger from fire is considered greatest. It is for the protection of your business, and for the protection of your homes that I urge you to act in this matter in a broad and comprehensive sense. I do not ask you to indorse any particular plan or scheme, or assume any responsibility, but it would seem to be proper and in keeping with the traditions of this Exchange to interest itself in this great public question, one of the most important that has ever come before you, and to take such action as will cause my plans to be looked into and examined and approved, if found to be in accordance with the facts stated.

PRESIDENT ORR:—We have heard you with very great interest, and I am sure the thanks of the Board are due you for the enlightenment you have given them on this very important subject, and it will be their pleasure and their duty to take into consideration the facts you have laid before them, and give you some expression of their opinion thereon.

NEW YORK PRODUCE EXCHANGE.

NEW YORK, November 17th, 1887.

MR. JOHN R. BARTLETT.

DEAR SIR:—

I am directed by the Board of Managers of the New York Produce Exchange to return you many thanks for your interesting address upon the present and needed water supply of the City of New York, delivered before its members on the 14th inst.

Assuming that you possess the control of the surplus water of the Passaic Water-shed, and of the partially constructed tunnel under the Hudson River, (about one-third of which is already built, and which you state it is your intention soon to finish,) the Board is of opinion that at an early date, a large supply of potable water, under very great head pressure, could be delivered by you at a given point in the 1st Ward in this City.

The members of the Board have heretofore understood that when the new Croton Aqueduct is completed, and the proposed storage dams constructed that are intended to impound the waters of the Croton Water-shed, that supply of water would be ample not only for the present, but for all prospective needs of New York for very many years to come, and that this adequate supply will be forthcoming at no distant date.

If, however, your statements are correct, to the effect that after the new aqueduct is completed, the water supply will not be increased except during the storm months, for the reason that requisite storage capacity cannot be constructed for from seven to ten years, and that even then the quantity to be obtained will come far short of the original estimate and of New York's then requirements,—there is undoubtedly grave cause for anxiety, which should suggest prompt and careful investigation.

In such cases it is not the province of this Board to do other than to express its opinion, and in view of the apparent practicability of your scheme, the endorsement it has received from the Board of Fire Underwriters, together with the urgent demands of the Dry Goods Trade and the Fire Commissioners, for a sufficient supply of water for fire purposes, which is to-day one of New York's greatest needs, and the further fact that it would be independent of the Croton system, the benefits of which are so ably pointed out by General Schofield, the Board respectfully commends the consideration of your plans and propositions to the intelligent judgment of the Commissioners of the Sinking Fund of the City of New York, who have been clothed by the Legislature of this State with full power of action in the premises.

Yours very truly,

A. E. ORR,
President.

OPINIONS FROM A MILITARY POINT OF VIEW
ON THE NECESSITY OF PROCURING AN ADEQUATE SUPPLY OF WATER FOR THE CITY OF
NEW YORK FROM

A SOURCE INDEPENDENT OF THE CROTON WATER-SHED
AND DELIVERED INTO THE SOUTHERN PART OF THE CITY.

LETTER FROM GEN. SHERIDAN.

WASHINGTON, December 8th, 1887.

MR. J. R. BARTLETT,

No. 2. Wall Street, New York.

SIR:—I have the honor to acknowledge the receipt of your letter and pamphlet giving in outline your plan for furnishing to the City of New York an additional water supply, from the mountain regions lying to the west of the Hudson River.

If you can successfully carry out your plan and furnish this new and independent supply, especially under the head of pressure proposed, such duplication cannot but be considered of great value from a military point of view. New York, the richest and most important city in the country, is now dependent for its water supply upon the storage works in the Croton Valley and the conduits some 30 miles in length from this valley to the city. All schemes for the defense of New York City in case of foreign war or domestic trouble must provide for the defense of these storage works and conduits, for it would be a fatal blow to further defense if these were once destroyed or securely held by an enemy.

If now a duplicate system of water supply existed, such as you propose, separated from the present Croton system by the wide and deep Hudson River, the chances of cutting off the water supply from the city would be greatly lessened and questions of defense simplified. It is far less probable that the country lying on both sides of the Hudson will ever be simultaneously controlled or operated in by an enemy, intent upon capturing or doing injury to New York City, than that one will be. It is also far from probable that mobs could be so organized and controlled as to act in concert and destroy at the same time two widely divergent systems of water supply, while it is easy to imagine a single system being so destroyed.

The contemplation of New York, or any other large city, deprived of its water supply, with the opportunities it would give to desperate and lawless men to burn and plunder, is so dreadful as to indicate the very great desirability of a duplication of such water supply, and of placing all works connected therewith as far as possible beyond the reach of destruction.

Such a duplication of water supply may at any moment become of inestimable value.

Very respectfully,

P. H. SHERIDAN,
LIEUT.-GENERAL.

LETTER FROM GEN. J. M. SCHOFIELD,

HEADQUARTERS DIVISION OF THE ATLANTIC, GOVERNOR'S ISLAND,

NEW YORK CITY, November 5, 1887.

JOHN R. BARTLETT, Esq.,

United Bank Building, No. 2 Wall Street, N. Y. City.

DEAR SIR:

I have read with great interest your address before the New York Board of Fire Underwriters, and the accompanying reports upon the subject of an additional and independent supply of water for the lower part of New York City; and in compliance with your wish I take pleasure in giving you briefly my views upon this important subject, as seen from the military point of view:

The military advantage of having two or more independent sources of water supply for a great city is very evident, and the importance of this is the greater in proportion as the sources of supply are the more distant from the city. If past experience may be relied upon as an indication of the future, any great city may at some future time, be exposed to attack by a hostile army. If a city so exposed is wholly dependent upon a single and distant source of water supply, the capture of that source would bring the city to immediate submission. Thus, for example, the defense of the City of New York, east of the Hudson River, must, under present circumstances, be made beyond the Croton watershed, or more than thirty miles from the City. For the moment that position was occupied by a hostile army, the City would be compelled to surrender. Whereas, the possession of another source of water supply, separated from the former by the Hudson River, would enable the City to hold out, unless assailed by a vastly superior hostile force, capable of operating successfully on both sides of that River at the same time. If an attack by a hostile army upon the City of New York may seem too remote and improbable to be considered as a ground for present action, it seems far less improbable that "domestic violence," even on a small scale, may manifest itself in the form of destruction of the works through which great cities are supplied with water. The great ease and rapidity with which modern high explosives may be made to accomplish such destruction suggests the wisdom of guarding against so great an evil by all possible means. One of the most effective of such means would be in the provision for an adequate supply of water from another and independent source. Lawless violence is not apt to be so well concerted as to work simultaneously upon quite separate and distant objects. Hence the destruction

of one may give timely warning for the protection of another. In this connection I cannot refrain from expressing the great surprise with which I have observed the almost total neglect of great cities in this country to adequately guard the water works upon which they are dependent for the preservation of life and property. As all our seaboard cities are open to attack in front by any foreign enemy, so they are exposed to destruction by any domestic mob that may choose to apply dynamite to their aqueducts, and the torch to their buildings. While it would not be proper for me to express an opinion as to the advisability of the adoption by the City of New York of any one special project, I am perfectly free to express my opinion of the great importance of having two or more independent sources of abundant water supply, thoroughly guarded against domestic violence.

Very sincerely,

Your Obed't Servant,

J. M. SCHOFIELD,
Major Gen'l U. S. A.

LETTER FROM MAJOR W. R. KING,

OF THE

COMMITTEE ON FORTIFICATIONS & MILITARY DEFENSE, ENGINEER SCHOOL OF APPLICATION,
U. S. A.

POST OF WILLETS POINT,

WHITESTONE, N. Y., November 9th, 1887.

J. R. BARTLETT, Esq.,
2 Wall St., New York City.

DEAR SIR:

In reply to your favor of the 2nd inst., requesting my "opinion from a military point of view as to the value of such a supply of water in addition to the Croton Service in time of war or similar disturbance," I would say that in time of war the absolute security of its water supply is one of the most vital questions to any city liable either to a siege or to a sudden attack by land or water.

It is not probable that any foreign army, however large, will ever obtain a sufficient foothold on our shores to undertake a regular siege; but on the other hand our well known weakness on the ocean, and in seacoast defense, invites an enterprising enemy to make sudden attacks along our coast; and among all our cities, none offers greater inducements for such attacks than the City of New York. Again there are many reasons why Long Island Sound would be selected as a field of operations by any powerful maritime nation. Without going into details, it may be stated that the Sound would furnish safe anchorage for all the navies in the world; it would enable an enemy to constantly shift his position to avoid torpedoes and at the same time enable him to send marauding expeditions to attack or threaten New Haven, New London, and other thriving towns along its shores.

He could also lie in the Sound north of Fort Schuyler and shell the upper end of New York with a possible chance, though, of course, not a very probable one, of sending a 2,000 shell through the High Bridge or some other vulnerable part of the Croton Aqueduct; or a small party of determined men could be landed at daylight, near New Rochelle, marched over to the Aqueduct, blow it up and return to their ships in time for breakfast. Of course, it is not claimed that these things are very probable or that they could not be prevented by due precaution, but in all such matters the *magnitude* of the calamity must be considered as well as its probability, in forming a true estimate of the danger to be guarded against; and as for preparation for such emergencies our well known lack of all adequate provisions for the wars we have been forced into, renders it highly improbable

that we will be any better prepared for the *next* war, when it comes, than we were for the last one

But the most serious danger to the water supply of New York comes from the possibilities, which the inventors of dynamite and other high explosives have placed in the hands of any fiends or cranks who may take it into their heads to declare war against civilized society on their own hooks.

The best security against all such calamities is to have two or more independent sources of supply; and the plan you propose seems at a glance to possess great merit on that account.

While the sources of supply are much nearer than the Croton water-shed, the locality is much less exposed to "war-risks," while the great additional head will make it especially useful in case of conflagration in the lower part of the city.

One or two ideas occur to me in this connection, which may have been already considered, but I will only offer them as suggestions without presuming to express an opinion on their merits, with the very limited study I have been able to give the subject.

1st. Is not the Brooklyn water supply equally if not more precarious than that of New York; and if so would it not be feasible to provide for one or more pipes across the East River in case a tunnel is ever built under the same?

2d. Would it not be better in some respects to put two 30-inch pipes in each tunnel, instead of a single 42-inch one, as proposed? They would have about the same cross section, and would seem to interfere less with the masonry of the tunnel, etc.

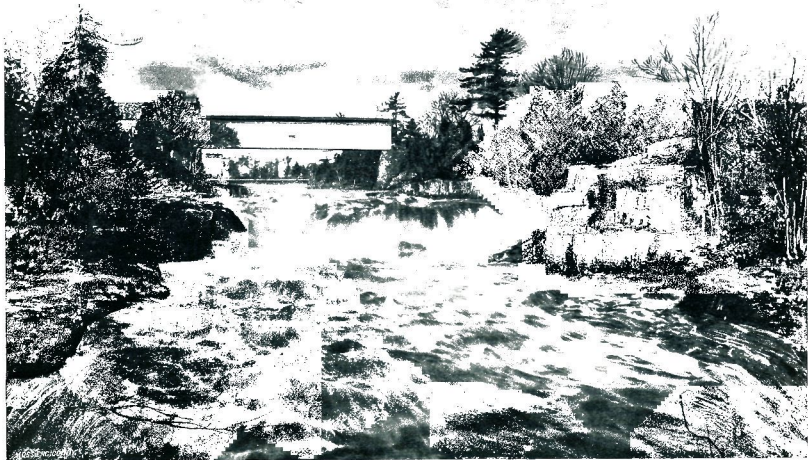
There are abundant precedents for multiplying sources of water supply in large cities. Rome had no less than eight independant aqueducts, the earliest of which is said to have been built by Appius Claudius, the builder of the wonderful "Appian Way"; London had no less than eight separate water companies a few years ago, and although the *companies* may have been consolidated, the sources of supply are doubtless even more numerous to-day, as several new and extensive projects for increasing the supply have been under consideration.

With its wonderful and irrepressible growth, the City of New York, surrounded as she is by briny water, can hardly be too lavish in procuring, or too jealous in guarding her supply of fresh water, and I would not be surprised if, in the lifetime of some who are now living, even the scheme to bring water from Lake George should become an accomplished fact.

Very respectfully, your obedient servant,

W. R. KING,
MAJ. OF ENG'RS, U. S. A.

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LITTLE FALLS.

On the Passaic River, 4 miles above the City of Patterson.

ADDRESS BEFORE
THE MEDICAL SOCIETY OF THE COUNTY OF NEW YORK,
ON
ADDITIONAL WATER SUPPLY TO THE CITY OF NEW YORK, INDEPENDENT OF THE
CROTON WATER-SHED.
DELIVERED AT THE
ACADEMY OF MEDICINE, SEPT. 24, 1888.
BY JOHN R. BARTLETT.

MR. PRESIDENT AND GENTLEMEN:

It gives me much pleasure, in response to your kind invitation, to address you this evening on the subject of the present inadequate supply of water to this City, and to present for your consideration our plans for procuring from a source independent of the Croton water-shed, the additional supply so much needed, to be delivered under conditions that will meet all demands for domestic, sanitary and commercial purposes; and for the protection of New York against conflagrations.

Much misunderstanding exists in the public mind in regard to the Croton water-shed; interested parties, writing and speaking from imperfect data or ignorance of the real facts, have shown a tendency to exaggerate its capacity and to understate the cost of construction and the time required to build the aqueduct and reservoirs necessary before the additional water can be delivered.

CAPACITY OF THE CROTON WATER-SHED.

The average annual rainfall in this latitude is a known quantity, fixed by regular measurements during a long period of years, and is stated to be about 43.8 inches, and the minimum annual rainfall to be about 30 inches. It makes a great difference in the figures stating the quantity of water that can be secured by storage or otherwise from a given area which data you use. The supply of water to cities must be regular and constant without interruption or diminution even for a single day, therefore, it is not safe to estimate on more than the minimum amount of rainfall, as more than that cannot be relied upon. It is also stated from experience and observation that 60 per cent. of the annual rainfall of the Croton water-shed is lost by evaporation, absorption by vegetation and percolation through the ground. This leaves 40 per cent. of the 30 inches minimum an-

nual rainfall that can be stored with certainty. This amounts to a sheet of water 12 inches in depth, covering the entire area of the Croton water-shed which is 361.82 square miles. One square mile of water 12 inches deep contains about 209,000,000 gallons of water; multiplying this by 361.82 square miles and divide the product by the number of days in the year, and it gives about 207,000,000 gallons for use each day in the year. If you take the average annual rainfall of 43 inches, 40 per cent. of which is 17 inches, that is 5 inches more than the minimum rainfall; this would give 17 inches in depth of water on each square mile of the water-shed or about 293,000,000 gallons a day; but this could not be relied on, for in dry years the amount would be much less.

In the report issued by the Aqueduct Commission of January 1, 1887, they place the entire amount that can be stored at 250,000,000 gallons daily. This suggests that their estimate is based on a middle course, nearly half way between the minimum rainfall and the average annual rainfall; but you must remember that this result can be secured only in full years and after the Quaker Bridge Dam and the storage reservoirs contemplated to store the whole available rainfall of the entire Croton water-shed are built. As these reservoirs have not been commenced, and as the head of the Public Works Department has recently told us it will take six years to build them after commencement, it is probable that it will be nine or ten years, perhaps more, before much increase in the present supply can be secured.

If we had 250,000,000 gallons of water daily it would be ample for the uses of this city, at the present time, but we cannot get it before a great many years, and when you consider the fact that our population is increasing at a rate unknown before in our history, adding yearly about 80,000 people, it follows that by the time the storage reservoirs are completed years hence, the city will then have grown up to their capacity and beyond it; and furthermore, when this water is actually ready for delivery, it will enter the northern end of the city as at present, and into Central Park reservoir at the same elevation as now, which is utterly insufficient for the high service districts and the demands down-town for fire protection and other purposes.

In other words an adequate supply of pure water under pressure sufficient to send it to the tops of the highest buildings to furnish adequate protection to all parts of the city can never be secured from the Croton water-shed and the question is what can be done to relieve the city from the great danger it is now in.

I will now call your attention to

THE PASSAIC WATER-SHED,

which is even less understood than the Croton. It is located in the State of New York and in the State of New Jersey; it is much nearer to New York City than the Croton water-shed, of much higher elevation; its streams and rivers derive their chief sources from a spur of the Appalachian Mountains, lying in both states, running in a south-westerly direction, having an elevation above tide water of 1000 to 1500 feet. The forest

clad hills of this region, by reason of thin soil, are unfitted for agriculture and contain but little matter soluble in water, underlying which and denuded in many places lies the granitic, conglomerate and trap-rock formations which absorb little of the water in its downward flow to the streams and valleys.

The Ramapo, Wanaque and Ringwood rivers take their rise in the State of New York, flowing southward they join the Pequannock River in New Jersey, and the three combined form the Pompton River, which flowing southward joins the Passaic River and journeys with it down to and over the Great Falls and away to the sea. The Rockaway River, or Western System, and the other sources of the parent stream, occupy the remainder of this remarkable water-shed.

Its area above the Great Falls exceeds 877 square miles, 40 per cent of the minimum annual rainfall of 30 inches gives a daily capacity exceeding 500,000,000 gallons. If we take the average annual rainfall as we have done in the case of the Croton basin, then the daily output from the Passaic water-shed above the Great Falls, will exceed 700,000,000 gallons daily delivery. From this amount take about 100,000,000 gallons daily, which belongs to the State of New York, although it all flows through the State of New Jersey, obeying the laws of gravity and not the imaginary line of the State, one half of the balance of 600,000,000 gallons per day, viz.: 300,000,000 daily, is sufficient to supply all the cities and towns east of the Orange Mountains, including Newark, Jersey City, and all the other municipalities embraced in the metropolitan district, and one-half of the City of New York in addition, for the next fifty years.

It is plainly evident that because of the quality of the water, and location and capacity, the Passaic water-shed is the only available place where New York can get pure water in the shortest time and at the least cost for that portion of the city needing it the most. This myself and associates propose to do in the following manner:

Having secured by purchase and contracts the necessary property and rights on the Passaic River below the point of proposed diversion, the waters from Rockland and Orange counties in the State of New York will run in their natural channels southward to such point, from there to the Great Notch reservoir in the Orange Mountains, and by suitable lines of pipe and aqueducts to the Jersey City shore of the Hudson River, (this reservoir being only fifteen miles distant from the City Hall, no further than Riverdale, our northern boundary line,) under which in strong steel pipes laid in a tunnel, to secure safety to the system and permanence to the supply, the water can be delivered into the lower part of New York in such quantity as may be desired under a head pressure of 300 feet, sufficient to send it to the tops of the highest buildings, to meet all demands for every purpose, including protection against large conflagrations, and we do not ask the City of New York to pay us any money until after the water shall have been actually delivered, and then only the price expressed in the contract.

The time has come to act in this matter, any further delay is dangerous, it may even be criminal in the appalling results that may follow a continuation of the present scarcity

of pure water. We do not want it in dribblets as we receive it now, but in volumes, with force enough to supply the fire department with power to prevent large conflagrations. It is needed for manufacturing, domestic, sanitary and commercial purposes. We need fountains in our public squares and public baths that shall be clean and healthy.

We have a suspicion that cleanliness is next to godliness, and we appropriate over a million dollars each year for street cleaning, and yet our streets remain foul, because there is not sufficient water to aid the department in removing the dirt. With plenty of water you could open the hydrants and flush the sewers and drive away much of the filth that breeds disease.

What a benison a rain storm is. How clean and sweet the streets appear after the water has done its work. Deliver plenty of pure water to every household and you will purify the atmosphere therein by reason of the constant flushing of the sewers, and thus prevent the production of the deadly gases and disagreeable odors that now affect nearly every dwelling in this city.

HIGH DEATH RATE OF NEW YORK CITY.

This City with its magnificent location, should be the cleanest, sweetest and healthiest in the world, but the high death rate tells us a different story. It is more unhealthy than New Orleans, Bombay or Calcutta, notwithstanding our salubrious climate and the refinement and comforts of our homes. Is not the principal reason of this the lack of an ample supply of pure water? I do not say it is the only one, but is not the lack of an abundant supply of pure water the principal one?

In regard to the mortality of this City, I find that the reports of the Health Department were published down to the year 1883, which year showed an annual death rate of 25.85 per 1,000 inhabitants. In 1884 the department for some reason stopped the publication of their annual reports. On examination of the reports issued by authority of the Registrar General of England, who publishes the rates of mortality of all the cities of the British Empire and the principal cities of the world, considered high authority, I find that for the year 1886 the annual death rate in New York City is given at 26. per 1,000, which is precisely the same death rate as in Bombay and Calcutta during the same year, which cities are well known to be the home of cholera and other malignant diseases.

Our own Health Department resumed this year the publication of their annual reports in the City Record, which is published by the city authorities. A careful examination of these reports for the last four months shows that the death rate in New York City has increased to 27.08, with Calcutta 25.47, and Bombay 26.07. At the present time the death rate in New York City per 1,000 inhabitants exceeds the death rate of Bombay or Calcutta.

The very able and efficient services rendered to this city by the present Health Department must be considered, to their credit, as otherwise the death rate would be much higher than it now is, if it were not for their watchful care in enforcing the law and the

use of every means in their power to lessen disease and improve the sanitary condition of the community.

The great city of the world, London, wiser than we, has several sources of supply, independent of each other, owned and operated by private corporations, and so arranged that in the event of accident to one system, connection can instantly be made with the others; thus a constant supply to all parts of the city is secured.

Other cities of the first and second class, viz.: Liverpool, Edinburgh, Glasgow, Bristol, Leicester, New-Castle, Paris, Vienna, Frankfort, Genoa, Munich, Dresden, and many others, the list is too long to mention, all have two or more independent sources of water supply.

WATER WORKS OF THE IMPERIAL CITY.

Did the ancient cities of the world appreciate safety, cleanliness and the luxury of an abundant supply of pure water more than we? It would seem so, for they built to a scale of great magnitude.

Rome, centuries before the beginning of the Christian era, when laying the foundation of that stupenduous power and civilization which enabled her in subsequent centuries to subjugate the whole world, first secured ample supplies of pure and wholesome water, the first necessity to the public health, a protection in time of war, a safeguard in times of peace, securing to her people that splendid physique and mental power which enabled her to win the great victories she afterwards achieved in every department of human life. The supply of water to the Imperial City exceeded 377,000,000 gallons per day, more than three times the quantity used in New York. This large amount was brought to the city through costly aqueducts which were wonderful triumphs of engineering science and skill in the art of construction.

The Claudia Aqueduct was about 46 miles in length, 36 miles through a tunnel, and 10 miles crossing the Campagna on a line of magnificent arches, delivering at a high elevation into the city of Rome about 96,000,000 gallons of water per day.

The Ania Novus Aqueduct was 62 miles in length, 48 of which were underground. It entered the city at the high elevation of 212 feet above tide water.

Portions of these aqueducts supported on lines of arches conveyed water in different directions, in all the most wonderful water works of any age, whose aggregate length exceeded 250 miles, and yet at no time during the building of these extensive works was the population of the Imperial City equal to the population of New York to-day. A full supply of water was deemed to be a necessity so great that it was secured at whatever cost.

I might mention the water works of Peru, in some respects the most difficult and wonderful achievements of any race or age. The Incas built aqueducts from the slopes of the Andes, tunnelled mountains and bridged valleys to bring water in ample quantities to supply their cities for the protection of their lives and property.

This has been the experience of all great cities in all ages, to procure at whatever cost, an ample quantity of water, from sources independent of each other, so that in the event of war, or domestic troubles, the destruction of one source should occur from any cause the others would survive, and thus save the city from capture or destruction.

The City of New York has only one source of supply and that insufficient to meet the present demand, which is increasing every day. Some parts of the city are entirely without a supply, many families are deprived of water, without they carry it in pails from the street, where it trickles with feeble pressure from the hydrants. The scarcity of water is so great that the use of hose for washing sidewalks, stoops, areas, house-fronts and stables is absolutely prohibited. This condition of things adds largely to the filth, odors and disease of the city.

A new supply of pure water is now a necessity. It should be secured from a source independent of the Croton water-shed and delivered into the lower part of the city under pressure sufficient to meet all needs of high service for domestic use, sanitary purposes and for the demands of commerce and manufacturers that the city may be freed from the present liability to epidemics and destructive conflagrations, and be what we all desire, the safest and healthiest city in the world.

PRESIDENT JOHNSON, Gentlemen :—You have heard this interesting lecture by Mr. Bartlett and it is now before you for consideration or discussion; and any question relative to the project which he has not already made clear, I am sure Mr. Bartlett would be happy to answer. Any remarks are in order.

GREAT DANGER OF EPIDEMICS.

DR. J. LEONARD CORNING :—If we can go fifteen miles from the City Hall and get such a water-shed as the learned gentleman has presented with such remarkable eloquence and scientific acumen this evening, I think we should do well to grasp the opportunity. It is merely a question of pocket. And as to the purity of the water I am perfectly willing to take Mr. Bartlett's statement in regard to that, as I am fully aware of his experience in all such matters. I know a little about this water, because I have been up in the region which Mr. Bartlett has described, and I think the sparse population and elevation of the lakes combine the qualifications for exactly the work which Mr. Bartlett will put them to. As to the simple question of getting the consent to use the waters, I fancy Mr. Bartlett has got that in his pocket. I would like to ask him if that is not so?

If Mr. Bartlett had come here to-night to ask us to sanction a scheme which would require a vote of money from the City of New York, I should oppose it most emphatically; he asks nothing from the City of New York, he proposes a scheme that to my mind is quite as equitable as the present aqueduct scheme. He proposes to carry the water to the City of New York, and when he has got it here to deliver it to us for the same price that the other water is delivered, and it may be less for aught I know. This seems equity in its purest form; this seems most excellent. It is a notorious fact that the lower part of

the city is in continual danger; there is danger of an epidemic there, and of a conflagration. This fact is notorious and has been continually referred to in the press. And when I speak of a conflagration, I mean that if a fire were to break out in that comparatively unprotected district, in a very few hours \$600,000,000 might be destroyed. This scheme requires no pledging on the part of this Society; but I will say that I think it is the fairest scheme of which I ever heard, it is the most extraordinarily liberal, and it seems to me that every patriotic citizen should support it.

CONDITION OF TENEMENT HOUSE DISTRICT.

DR. GEORGE F. MORRIS:—I think that I am in a position to say that fully 75 per cent of the tenement houses of the City of New York, and I think I have been in every district, is not supplied with water by natural pressure above the second or third story at any time in the day from 7 o'clock in the morning until 6 at night, except perhaps between the hours of 12 and 1. I can also state positively, that even in the newer tenements, in which the law requires all the closets and sinks to be adequately flushed, where water is provided by pumping in tanks on the roofs, that in many of them, where water is carried, there is neglect on the part of the owners and trouble on the part of the janitors to supply that water, and I have frequently found the closets in these houses not flushed through several floors, and it became necessary for me to make a complaint and enforce the law. Now I know there is hardly a tenement house in the city of New York, if a man will go there day after day, that has enough of water. That is the question we are to look at. Many of our diseases such as the malarial fever, typhoid, diphtheria, scarlatina, etc., are due almost wholly to the scarcity of the supply. You go into those houses and you will find a fearful stench. The tenants being careless, the closets are not thoroughly flushed and remain in a foul condition to fester through the warm weather.

I must say that I am in favor of an increased supply to the City of New York. Many of you perhaps are not aware of the condition of the stream, called the Bronx, which now furnishes us with water. This stream is almost throughout the whole year filled with decomposed vegetable matter and should not be used for a water supply.

So far as the City of New York getting the supply of water we have been promised, when the present works have been put in operation, we are told we are to wait two years longer. It is questionable whether we will get water then, and if we are obliged to wait until the Quaker Bridge Dam is finished, and the water collected from that section of the country, it will be six and perhaps eight or ten years before we get it. The question of going to Lake George is one which I think will never be entertained by the city. We could go into Connecticut and get a supply of pure water at a much less expense.

I think Mr. Bartlett's plan is a very feasible one. He certainly has expressed himself as if he knew what he was talking about. I think he should receive the support of this Society inasmuch as it is a question of supplying the City of New York with an additional supply. That is all the Society has to indorse to assist him. The authorities are

the ones who will determine to receive it or not, it is simply for the Society to endorse his plan, and I am heartily in favor of it.

WATER IN TANKS ON HOUSES BECOMES UNHEALTHY.

DR. ED. C. HARWOOD:—I am in favor of this Society approving the methods and plans that have been advanced by Mr. Bartlett to procure and deliver to this City a full supply of water so much needed. We do not commit the members of this Society or the citizens of this county to any financial liability. Anything that will add to our water supply certainly is one that should be considered favorably by all, not only the members of this Society but the entire community. I am located between 5th and 6th avenues on 49th street, and I experience very great difficulty in getting a proper supply of water. I do not wish to have a tank on top of my house to resort to the use of water that will become stagnant there, as is done in many instances. I favor the proposition which is offered by the author of the plans, and hope we will be fortunate enough to have it adopted by the city. We want to indorse it, it is a good one.

PRESIDENT JOHNSON:—Are there any further remarks? If not, Mr. Bartlett will answer the questions that have been asked.

MR. BARTLETT:—The full discussion here this evening on this very important and interesting subject has afforded me much satisfaction, emphasizing more clearly the strength of my proposition. Several gentlemen present have asked questions which I am very glad to have the opportunity to answer.

OWNERSHIP AND CONTROL OF THE PASSAIC WATER-SHED VESTED IN PRIVATE PARTIES AND NOT IN THE STATE.

FIRST.—There is great confusion in people's minds about riparian rights on rivers and streams not navigable. The Passaic River and its tributaries are not navigable rivers, except that portion of the lower Passaic in which the tide ebbs and flows, below the City of Passaic. They belong to the people who own the bed and banks of the same—private owners—farmers, manufacturers and corporations, who hold titles which go back over 200 years, before the State of New Jersey existed. The State does not own, and it never did own one gallon of this water, neither has it anything to do with the flow of these non-navigable rivers or with the use thereof. The State can acquire water and water rights in the same way that we have done, or as any one else may do, namely by purchase and payment therefor, possessing but one additional right, the sovereign power of exercising the right of eminent domain for the public good, but only on payment for the property taken. The State has no more control over the non-navigable rivers within its boundaries than it has over any other property of its citizens, coal, iron, cord-wood, or flour, the products of its soil and the property of its people who have the unquestioned constitutional right to sell

their own property to whom they please, whether the buyer lives in the State, or out of it, in some other State, and such buyer may convey the property he purchases in the State of New Jersey, whether it be coal, iron, hay, oil or water, on the cars or by canal, or by pipe lines into their own state, without interference by the State of New Jersey, as Congress alone can interfere with commerce between the states.

ADVANTAGES OF PRIVATE OVER MUNICIPAL CONTROL OF WATER WORKS.

SECOND.—I do not agree with the suggestion that the City should own and operate its own water works. There is no good business or practical reason why the City should go into the business of building and operating water works to supply its citizens with water, any more than that it should build gas works and lay gas pipes in the streets to illuminate our dwellings, or to deliver coal at our houses, all of which is now supplied by private parties to the satisfaction of the community. I know that many people entertain that idea, but it is an old one and belongs to a past age. When our population was small, to supply a town or city with water was considered such a great undertaking, that in self-preservation the community was obliged to build their own works or go without water.

In the year 1800, there were only 8 systems of water works in the United States, all of which were owned and operated by cities and towns. There were no private water companies in existence at that time, except one now existing in Morristown, N. J., incorporated in 1799. In 1887, published statistics show that 621 cities and towns in the United States and Canada supplied themselves with water, owning and operating their own works, and 780 cities and towns were supplied by private water corporations. The same published statistics also show that private corporations supplying cities and towns with water have increased over 456 per cent. during the past 7 years, while the increase of water works under municipal control during the same time is but 56 per cent. This is conclusive and unanswerable proof that private corporations supplying large communities with water are more advantageous to them than when they undertake to supply themselves, or these figures would be reversed. The cities and towns that get their supplies of water from private corporations, as the record shows, occupy the enviable position of having a better service, more satisfactory rates, freedom from the heavy debt incurred by the corporation in the creation of its own water supply construction; and furthermore such cities are free from the jobs and political corruption and waste, which, to a greater or less extent surrounds all great public works when managed by any municipality.

I need only point to the Washington aqueduct scandal now coming to light; also I might touch lightly on the investigation that has been going on here lately this past summer, which has divulged the fact that the present new aqueduct, which we were informed five years ago would cost about \$10,000,000 to build and would occupy two and a half years in its construction, has now occupied four years in construction and not yet completed, and that it has already cost about \$16,000,000, and will cost \$4,000,000 or

\$5,000,000 more to complete it. This is only a sample of what the cities and towns have to stand when they undertake such works themselves. The City of London, the largest commercial city of the world, has had some experience in supplying itself with water, the result is that the whole city is now supplied by private corporations.

OLD SYSTEM OF PIPES IN OUR STREETS UNFIT FOR PRESENT USE.

THIRD.—In reply to the next question I wish to state that it will be necessary to lay pipes in some streets of greater strength and larger capacity than those laid 40 or 50 years ago, which were of size and strength suitable to the requirements of that day, when 4 story buildings were the highest. The City down town is still drawing water out of those old pipes, which are even smaller and weaker than they were by reason of corrosion and lapse of time, and are now doing double duty, hence the danger. A new and stronger system will be required to meet the demands of larger growth.

In regard to the plumbing in the houses in New York City not being strong enough to stand the increased pressure, that is to some extent true, as it depends upon the elevation of the house above tide-water; but the pressure on the pipes and plumbing in the houses need be no greater than at present, because connections with the mains in the streets can be made directly to the top of the house, or the pressure lessened to the required strength of the pipes by the use of reducers. There will be no trouble in reducing the pressure to the strength of the plumbing in each case.

AUTHORITY TO CONTRACT WITH A PRIVATE WATER COMPANY.

FOURTH.—In answer to the gentlemen who suggested that any official action taken by this Society might be construed as casting some reflection on the Legislature of this State, or the Aqueduct Commissioners of this City, permit me to state in reply that the Legislature, when it created the Aqueduct Commission to superintend the building of the new aqueduct, passed laws through both houses almost unanimously authorizing private water companies to furnish the City of New York with an additional supply of water from Rockland and Orange counties; and also empowered the Commissioners of the Sinking Fund of this City to contract with such private water company to deliver the water required by the City, and in addition the Legislature authorized and empowered the said Commissioners to issue bonds of this City, if necessary so to do, to build a special system of pipes for fire service purposes, of strength sufficient to stand the increased pressure.

Therefore, gentlemen, the record clearly shows, that any action of this Society favoring this City procuring an additional supply of pure water under pressure from a source independent of the Croton water-shed, would be in harmony with and supplementary to the acts of the Legislature and the Aqueduct Commission, who have done, and are doing all they can to get more water to the City; and such action would be in the highest degree favorable to the interests of New York City, its health and safety.

DR. DAVID WEBSTER:—I have been intensely interested in this subject of an additional supply of water to the City of New York, as proposed by Mr. Bartlett, for some thing over a year, and having the good of the City of New York at heart, I earnestly wish that Mr. Bartlett may succeed in getting the consent he wants, to place this water supply at our use.

I hold in my hand a resolution which I hope this Society will adopt unanimously, as I think it will aid in getting more water into the city, as the approval of the Medical Society of the County of New York would probably have some influence upon the City Authorities.

(The Doctor then read and moved the adoption of the preambles and resolution which was seconded by Dr. Edwin E. Swift, and carried.)

RESOLUTION

ADOPTED BY

THE MEDICAL SOCIETY OF THE COUNTY OF NEW YORK.

At a stated meeting of the Medical Society of the County of New York, held Sept. 24th, 1888, the following Preambles and Resolution were adopted:

Whereas: The present scarcity of water in this City is causing great inconvenience as well as serious apprehension for sanitary and other reasons, and

Whereas: The new Aqueduct will not materially increase the present supply from the Croton water-shed until after the storage reservoirs are completed, six or more years from now, and

Whereas: The upper portion of the City with its rapidly growing population will soon require all the water that can be procured from that source, and

Whereas: The present insufficient supply of water is a constant menace to the health and safety of the City, inviting scarlet fever, diphtheria, cholera and other malignant diseases, as well as disastrous conflagrations. Therefore be it

Resolved: That this Society has listened to the explanation of the plans proposed by John R. Bartlett, Esq. for furnishing the City of New York with an additional supply of pure water, from a source independent of the Croton water-shed, and that it approves the same and urgently recommends it to the attention of the City Authorities having such matters in charge.

LAURENCE JOHNSON, M. D.

President.

CHAS. H. AVERY, M. D.

Secretary.

Rights of Diversion in the State of New York
of Water Flowing into the State of New
Jersey.

Ownership and Rights of Diversion, in the
State of New Jersey, of Water in the Pas-
saic Water-Shed.

OPINION OF EX-CHANCELLOR THEODORE RUNYON.

NEWARK, N. J., October 12th, 1888.

JOHN R. BARTLETT, Esq.

DEAR SIR:

You ask my opinion upon the following questions:

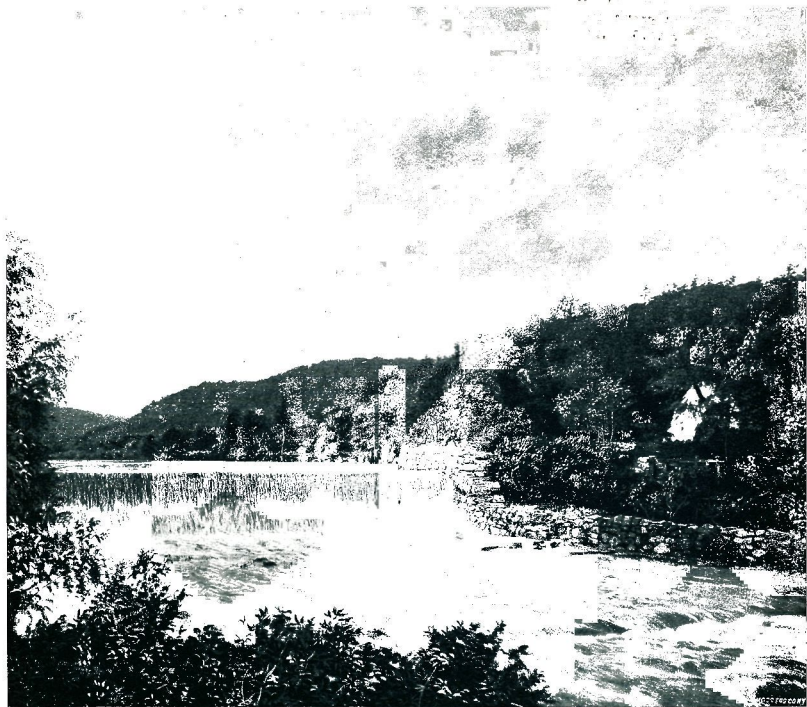
1. Can the State of New York, the City of New York, or any private water company, of that State, divert by condemnation proceedings or otherwise, without the consent of riparian proprietors in New Jersey, any water from the Ramapo, Wanaque or other streams having their sources in the State of New York, and flowing into the State of New Jersey, so that by reason of such diversion riparian proprietors on the Passaic River, or any of its said tributaries in the State of New Jersey, will be deprived of the natural flow of said rivers?

2. Can a properly organized corporation in New Jersey, such as the Montclair Water Company, divert from the State of New Jersey New York State water, provided it has acquired by purchase and by contracts full title to such water below the point of diversion on the river? Can the Legislature of the State of New Jersey interfere to prevent such diversion to the City of New York when the parties proposing to divert such waters, have contracts permitting such diversion with all users of water?

3. Could the cities of Newark, Jersey City or any other municipality dependent upon the Passaic water-shed for its supplies of water, interfere with such proposed transportation or diversion of such New York water through the State, provided the amount of water diverted to the City of New York from the tributaries of the Passaic River in the State of New York does not interfere with the ample supplies provided for said cities and towns in New Jersey?

4. Does the State of New Jersey own, or does it have any legal control whatever of the waters in the non-navigable rivers and streams within the state boundaries, the property of its citizens; and can the State acquire any right in said waters, or control of same, except by the exercise of the right of eminent domain, the same as it would have to do in the purchase of any other property, if it could not agree with the private owners?

To the first question I answer:



RAMAPO RIVER.

In Orange County, State of New York, showing the volume of water flowing south into the State of New Jersey.

The right of a riparian owner in New Jersey to have the water in the stream which flows from New York into that State flow as it has been accustomed to flow, cannot lawfully be injuriously affected in the State of New York, by diversion either by a riparian owner there or any one else, and the State itself cannot lawfully either divert or give authority to divert, the water to the injury of the New Jersey riparian owner. By the exercise of the right of eminent domain the State of New York may take property within its borders, but obviously it cannot take the property of citizens of other States outside of its limits. The right of the New Jersey riparian owner to the water is a property right, and while the State of New York may take or authorize the taking of the property of the riparian owner there, it can affect only what he owns—his rights, whatever they may be.

To the second question I answer :—

The owner of water in New Jersey may divert it from that State under the circumstances stated in the question, and the legislature cannot prevent him from doing so, except by the exercise by the right of eminent domain. A corporation organized under the law under which the Montclair Water Company was created, would be bound to provide a supply of water for the place (city, town or village) to supply which it was established, as a primary and paramount obligation in disposing of its water, unless indeed such place had obtained its supply elsewhere.

To the third question I answer :

Neither Newark nor Jersey City, nor any other municipality which the Montclair Water Company should not be bound to supply with water, could interfere with such diversion of water from the State by the company, except by the exercise of the right of eminent domain.

To the fourth question I answer:—

The State of New Jersey has no control over the water in the non-navigable streams within its borders, the property of its citizens, to prevent them from disposing of the water thereof at will, as property, except by the exercise of the right of eminent domain.

Yours truly,

THEODORE RUNYON.

1. The State of New Jersey does not own any water in the Passaic Water-shed, and can acquire it only by the right of Eminent Domain.
2. Rights of the Morris Canal and Banking Company, or Lessees, to sell its waters now used for navigation purposes.

OPINION OF HON. BARKER GUMMERE.

NEW YORK, October 9th, 1888.

HON. BARKER GUMMERE.

MY DEAR SIR;

Permit me to add to my letter to you of this date the following questions, viz.:

1. "Does the State of New Jersey own, or does it have any legal control whatever of the waters in the non-navigable rivers and streams within the state boundaries, the property of its citizens; and can the State acquire any right in said waters, or control of same, except by the exercise of the right of eminent domain, the same as it would have to do in the purchase of any other property, if it could not agree with the private owner?"

2. "Also please inform me if the Morris Canal and Banking Company or the Lehigh Valley Railroad Company, lessees, have not under legislative authority the clear and undisputed right to sell and deliver to whom they please, whether it be the City of New York, the City of Newark or a private water company, all of the waters now stored, owned and used for navigation purposes."

Yours truly,

J. R. BARTLETT.

Trenton, October 12th, 1888.

JOHN R. BARTLETT, Esq.,

DEAR SIR:

In answer to the questions contained in your letter of October 9th, 1888, a copy of which I append hereto, after careful consideration I reply as follows:

1. The State of New Jersey does not own any non-navigable waters or streams within its boundaries, nor has the State any proprietary right whatever in the same; but the State can acquire such ownership or proprietary right by the exercise of its power of eminent domain, and by that means only.

The State acquired title by conquest from the Crown of Great Britain, to all rights of property at the common law which were annexed to the Crown as *jura regalia*; and in respect to the streams and waters within the boundaries of the State the proprietorship

of the Crown was strictly limited to the shores and beds of streams in which the tide ebbs and flows, the State owns the shores and beds of such tidal streams, and has a qualified property in the waters flowing therein, *below* the head of the tidal flow; the shores and beds of such streams *above* the tidal flow belong to the riparian proprietors. The State of New Jersey has the police control of the waters of such streams above the head of the tidal flow, and in my opinion might prevent such a use of the water above the head of tide as would impair the navigation of such streams below the head of tide water, but the State has no other power over the waters of non-navigable streams above the head of tide water, excepting its governmental control over all property situate within its borders, subject to the limitations of its own constitution and the constitution of the United States.

2. By an Act of the Legislature of the State of New Jersey, approved March 28, 1888, any Canal Company and any lessee of any of its franchises and works, is empowered "to lease, sell or otherwise dispose of all or any part of the real and personal estate now or hereafter owned, possessed and used by such company and its lessee." This is an absolute power of lease or sale, and is wholly unfettered and unqualified by any provision or phraseology in the context of the Act. Any canal company or its lessee is empowered to lease or sell to any vendee, its waters which it owns, possesses and uses, whether such vendee be in or out of the State of New Jersey, or whether such vendee be a natural or artificial person; if such vendee be a corporation, it must, of course, have the corporate right and power to take and hold the waters leased or sold to it, and upon such sale being completed the vendee corporation would become seized and possessed of the waters sold, with power to use the same for its corporate purposes, subject only to the liens and contracts theretofore created or made by the vendor canal company.

If therefore the City of New York, or a private water company organized under the laws of the State of New York, is empowered by its charter to purchase water out of the State of New York and bring it into said State, either the City or such corporation is empowered by the Act of March 28, 1888 (P. L. of N. J., p. 300), to buy from the Morris Canal and Banking Company and its lessee, The Lehigh Valley Railroad Company, all or any part of the waters now owned, possessed or used by said corporations, and may transport the same into the City of New York, and there sell and deliver such waters to whomsoever they may elect, provided no injury is thereby done to the navigation of the Passaic River at and below the existing head of its tide waters.

BARKER GUMMERE.

1. Rights of Diversion and Transportation of Water, in the State of New Jersey.

2. Rights of Newark, Jersey City, etc., defined.

OPINION OF HON. BARKER GUMMERE.

TRENTON, N. J., October 17th, 1888.

J. R. BARTLETT, Esq.,

No. 2 Wall St., New York.

Dear Sir:

You ask my opinion in reply to the following questions:

1. Can the State of New Jersey interfere with our transportation of water from the State of New York through its territory, in its natural channels, and by pipe lines to the City of New York, providing such diversion of water caused no impairment of navigation in the lower Passaic, and with the consent of riparian proprietors below the proposed point of diversion.

2. Could the cities of Newark, Jersey City or any other municipality in the State of New Jersey interfere to prevent such diversion?

I infer you propose to conduct water from the State of New York, through New Jersey, into the City of New York, by virtue of powers conferred by the State of New York upon a corporation of that State, either *in esse* or about to be organized; and that you also propose to consolidate the New Jersey and New York corporations, under the provisions of the act of the legislature of the State of New Jersey, approved April 12th, 1876. (Sec. 12, Pamp. L. of N. J., p. 112.) If such a consolidation has been or shall be effected, I am of the opinion that the consolidated company could exercise in the State of New Jersey the power conferred on the New York corporation, of storing water flowing in the State of New York, and could conduct the same into the City of New York, for sale, for domestic use and the extinguishment of fires, subject however to the limitations and restrictions contained in the New Jersey act as to private rights and property. The corporate power of a water company organized under the laws of the State of New York could not be exercised in the State of New Jersey without the consent of that State. This consent is given by Sec. 12 of the Act of April 12, 1876, above cited by which the consolidated corporation may use and operate the works of either of the consolidating corporations, and is clothed with the franchises of both or either of such consolidating corporations. As the franchise of transporting water through the State is clearly conferred upon the New Jersey corporation by the New Jersey statute, and as there is no provision or restriction contained in the New Jersey act which imposes limitations on the exercise of such franchise, excepting provisions and restrictions concerning the rights and property of private persons, I am of the opinion that such consolidated corporation would have the power of conducting waters stored in the State of New York for the supply of the inhabitants of the City of New York, through the State of New Jersey into the City

of New York for the supply of its inhabitants, provided the quantity of water so conducted into the City of New York did not exceed the quantity of water derived from waters within the territorial boundaries of the State of New York.

The State of New Jersey could not therefore under existing laws interfere with the transportation by the consolidated company of waters taken by it from the streams of New York through the State of New Jersey into the City of New York for the ordinary use of its inhabitants if there be a necessity for such ordinary use.

2. Neither the Cities of Newark, Jersey City or any municipality dependent upon the Passaic water-shed for its supply of water, could have any possible standing in any court of law or equity, to question or interfere with your proposed transportation through New Jersey of water from the headwaters of the Passaic in the State of New York, into the City of New York for the ordinary use of its inhabitants, so long as such cities and municipalities can obtain an ample supply of water from the Passaic River.

Very respectfully,

BARKER GUMMERE.

HEALTH DEPARTMENT OF THE CITY OF NEW YORK.
PRESIDENT'S OFFICE.

New York, October 18th, 1888.

MR. JOHN R. BARTLETT,
No. 2 Wall St., City.

DEAR SIR:—

I beg to acknowledge your letter of Oct. 17th, in which you ask two questions concerning which you desire an expression of my opinion. These questions, as I understand them, are in effect as follows: First. Does the necessity exist in New York for a more abundant water supply, especially in the tenement house districts and other portions of the City lacking an adequate supply at present? Second. Would an additional supply of pure water, under sufficient pressure to insure a good distribution, tend to the reduction of malignant diseases and improvement in the public health and “a reduction of the present death rate?”

1. It is undoubtedly true that, at the present time, large portions of New York are very inadequately supplied with water. This Department has constant and serious trouble in that branch of its work which deals with the plans of tenement houses and other dwellings, owing to the fact that the available supply of water is in many cases so small as to forbid a proper cleansing of plumbing fixtures if these are provided. There are large districts of the City where the pressure rarely carries the water above the first story, and in the case of tenement houses, divided into many apartments, each apartment must be provided with one or more pumps, which finding their supply from the 3-4 inch tap at the street main, are not always able to lift the water required for domestic use. A good water supply, abundant in quantity and excellent in quality, is a condition precedent to the healthfulness of a community. This is especially true of a crowded community like New York. I am of the opinion that no one thing would do so much to facilitate and make effectual the work of this Department as a great and immediate increase in the water supply under pressure sufficient to reach the upper stories.

I am unable to favor, from a sanitary point of view, the measures which have been suggested, looking to a restriction of consumption in order to prevent the present admitted large waste. A liberal use of water accomplishes what can be attained in no other way—the cleansing of pipes and sewers; and people who have access to all the water they desire and can use, are likely to be cleaner in their homes and persons than those who suffer restrictions in this most important item of daily consumption. I do not think the

sanitary aspects of the question with which we are now confronted, growing out of an admitted scarcity of water in New York, can be exaggerated.

2. An increased supply, and better distribution of water in New York would undoubtedly tend to diminish the number of contagious and infectious diseases with which we now have to deal, and would produce a marked improvement in the public health. If it were not for its peculiar position, as the gate-way of this continent, to which more than 80 per cent. of the inflowing travel and immigration tends, our death rate would not be so large as it is. For example, if the deaths among immigrants who have never become a part of our population, could be eliminated from our totals, we should last year have reduced the death rate per thousand, from 24.5 to 22. If, further, we could avoid the over-crowding of Italian, and other impoverished immigrants in our tenement house districts, our death rate would compare favorably with that of the most healthful city of the world.

It will not do, however, to attach too much importance to these hopeful figures. They are liable, at any time to be changed, and nothing will tend so quickly and effectually to change them, as a failure in the water supply of the city. Of the dangers to which this is subjected I do not need to tell you.

Answering your question with reference to the effect which an increased water supply would have in diminishing the number of malignant diseases of a contagious or infectious type, I regret that I am unable to be specific. This, of course, is largely a matter of opinion, but it is an interesting fact, that a very large proportion of the cases of contagious and infectious disease which come under the care of the Board of Health, are taken from the upper floors of tenement houses. Whether this is due to lack of water which is greatest on the upper floors, or to impurities in the water which rise to about that level, I am unable to say. I believe, however, that a material increase of the City's water supply, would promptly and permanently reduce the public burdens entailed in the care of the City's sick.

The cordial sympathy and co-operation of this Department, would be extended to any practicable scheme looking to a supply of water for New York from other sources than the Croton watershed. Our City is growing with great rapidity, especially in the 23rd and 24th Wards, north of the Harlem River. It is probable that the needs of this district will not be more than met by the increased supply to be obtained through the new aqueduct, when all the engineering work looking to the impounding of additional water is completed.

Respectfully,

JAMES C. BAYLES,
PRESIDENT.

LETTER FROM PROF. C. F. CHANDLER, OF COLUMBIA COLLEGE,
ON THE SANITARY CONDITION OF NEW YORK.

J. R. BARTLETT, ESQ.

2 WALL STREET, NEW YORK.

NEW YORK, Nov. 27th, 1888.

MY DEAR SIR :—Please accept my thanks for the proof copy of your “outline of plan for furnishing an abundant supply of water to the City of New York, from a source independent of the Croton water-shed.”

I have read it with great interest and am convinced at once of the great advantages and the practicability of the plan, even without the assistance of the unqualified endorsements of the distinguished engineers and other citizens, with which it is accompanied. It is now more than twenty years since, while serving as chemist to the Metropolitan Health Department, my attention was first called to the importance of an abundant supply of pure and wholesome water for the City of New York, and my interest has steadily increased as I have become more familiar with the subject.

In 1867 or '68 I was appointed chemist to the Croton Aqueduct Department, and made a careful study of the Croton water-shed and all the sources of the water supply, and I have since that time, availed myself of every opportunity to urge the importance of a large increase in the quantity of the water supply, to meet the various requirements of the rapidly growing city.

I am satisfied that the health and comfort of our citizens depends largely on the character and adequacy of the water supply.

Various plans have been suggested for removing the most offensive and dangerous kinds of city refuse, but while several of them may be applicable to smaller cities and towns favorably situated, there is but one available plan for New York City, that is the

WATER CARRIAGE SYSTEM BY SEWERS.

The first requirement for this system is an abundant and never-failing supply of water, under a sufficient pressure to reach the upper stories of all our buildings.

This we have never had within my recollection, and what is more to the point, we have been every year worse off than the year before, on account of the rapid increase in the population, the large increase in the number of buildings to be supplied, and the multiplication of large factories, street and elevated railways, steam tugs, &c. In 1873 the water was abundant in the fourth story of my house, a year or two later it ceased to reach this story, and not long after it deserted the third story, and at present rises only to the second story.

This is the experience of thousands in the upper part of the City, and great trouble and constant expense are consequently entailed in the introduction of pumps and tanks, which at best give a very uncertain and inadequate supply. Buildings in the lower part of the City, and especially the small houses of the less favored citizens, and the tenement

houses are in a much worse condition, and in a large proportion of them all the water used must be carried up by hand from the lower stories and from the yard.

The inconvenience of the inadequate supply is an evil of great magnitude, but is insignificant when compared to the injury to health, which results from the imperfect flushing of house drains and fixtures and of the public sewers. Most of us hoped that the new aqueduct would remedy all these difficulties, and that we should soon rejoice in an abundance of water. But it seems that our patient waiting will avail us little. We now learn that the new aqueduct will add little to our water supply, and that before there can be any material relief from the present scarcity either one very large dam or several small dams must be constructed to collect and hold the water in the Croton water-shed. Years must elapse before the additional work can be completed. Meanwhile the evil continues to grow in magnitude, involving great personal annoyance and expense, much sickness, and an undoubted increase in the death rate.

More than this the rapid increase in the population will finally result in a deficiency of water from the Croton water shed, even though all the required dams be constructed, and the old and new aqueducts employed to bring the water to the City.

The truth is, the

CROTON WATER-SHED WILL NOT SUPPLY ENOUGH WATER FOR THE CITY OF NEW YORK.

By the time all the dams have been completed, or soon thereafter, the population of the City will have out-grown the Croton water-shed. We shall then be driven to some other source of supply.

These are the considerations which induce my approval of your plan for supplying the lower portion of New York, with water from an entirely independent source, under a sufficient pressure to reach the upper stories of the higher buildings.

Your plan seems to meet every requirement.

1st. It can be executed in a very short time, long before the even limited increase in the Croton can be realized.

2nd. The water is of the most satisfactory quality, the water-shed being specially well suited for collecting the rain fall and delivering it without contamination.

3rd. The quality and pressure will be sufficient for all purposes, including the flushing of house pipes, drains and sewers, and the extinguishing of fires.

4th. The water which it will supply will be introduced at the lower end of our system of mains, where it is most difficult to get the Croton.

5th. The water will come from an independent source, which is of the utmost importance, as we are ever liable to have our Croton supply cut off by accidental or intentional injury to the aqueduct, at some point between the Croton Lake and the City. Finally I would say that your plan has my unqualified approval.

Very sincerely yours,

C. F. CHANDLER, PH. D., M. D.

REPORT
ON THE SANITARY CONDITION OF THE CITY OF NEW YORK,

BY

MOREAU MORRIS, M. D.
STEPHEN SMITH, M. D.
CHARLES E. LOCKWOOD, M. D.

CYRUS EDSON, M. D.
ROGER S. TRACY, M. D.
E. H. JAMES, M. D.

Office, 109 E. 73rd Street,
NEW YORK, December 6th, 1888.

J. R. BARTLETT, Esq.,

No. 2 Wall Street, N. Y.

DEAR SIR:—

Replying to your inquiries, in relation to the sanitarian condition of this City and the necessity for more water, we would state that, from practical experience and study of the sanitary conditions of this City for the past 22 years, while connected with the Health Department in various official capacities, from an assistant inspector to the sanitary superintendent of the Department, my opportunities in connection with Sanitarians of experience and practical knowledge working on the same lines, have brought vividly the question of a more abundant water supply, as the greatest necessity now required for this rapidly growing City.

During this long service, there has been no detail of that kind of work left undone of house to house visitation among every class, from the humblest shanty, the private dwelling, the flats and tenement houses that are found within the limits of this City—stores, warehouses, business places, manufactories, in fact every place where the human race live, dwell, do business, or occupy permanently or temporarily during the day or night—and that as a result of this practical knowledge and experience we have advocated and urged the City Authorities during the last 7 or 8 years to provide a more abundant and constant supply of water to this City.

These efforts have had their effect in the endeavor to supply the City through the new aqueduct now being constructed.

But it appears from the great difficulties met with, in securing the abundant supply needed from the sources proposed by means of the new aqueduct, and the fact now admitted that several years must yet elapse before that can be accomplished, the City must necessarily suffer not only in health and financially but in large insurance rates and

RESTRICTED MANUFACTURING ENTERPRISES.

Already, in many densely populated sections of this City, where manufactories are

located the supply of water in the dwelling and tenement houses is very largely restricted, the supply not reaching even the first story during the working hours of these factories. As a consequence, the water carriage system for the rapid removal of sewage and waste during these hours, from 7 a. m. to 7 p. m. daily fails of its purpose. This deficiency for flushing purposes results in accumulations in the sinks, and water-closets throughout these houses, impregnating the atmosphere with the foul and poisonous emanations of decomposing animal and vegetable matters. It does not require the expert knowledge of a hygienist to assert the great danger to health therefrom.

DEATH RATE INCREASED.

That the death rate is increased by an insufficient supply of water, can hardly be doubted and when comparisons are made with other cities, provided with an abundant supply, the fact becomes patent to any unprejudiced person. That the high death rate of this City would become much less with an abundant supply of water almost goes without saying, especially among sanitarians.

The increased death rate alone is not, however, the only view which presents itself, the

SICKNESS RATE OF A POPULATION

has a more important bearing upon this question. For every person sick there is a corresponding loss of working force or productive element.

The sick must be attended to and usually by two or more persons during that period, be it long or short. Hence the sickness rate is a direct expense account against production and a positive and large financial loss to the whole community.

The wage earner is deprived of his or her income, and with many the sufferings of poverty, resulting from enforced idleness, must supervene upon the loss of health or attendance upon the sick. Therefore, *if there is any way or means by which the City could be rapidly and expeditiously supplied with an abundance of pure water both its healthfulness and its prosperity would be rapidly increased. Its human life would be prolonged, its death rate reduced, its fire dangers lessened, and its desirability as a permanent residence enhanced.* Insufficient water supply adds largely to the cost of building, as other means must be adopted than direct pressure to obtain water for the upper stories of dwellings and for factory purposes.

FORCE PUMPS AND TANKS IN TENEMENT HOUSES.

Even in the ordinary tenement the addition of large tanks and force pumps to force the water into them on the tops of houses becomes a necessity and involves a very large expense, hardly ever less than 12 to 1500 dollars per house. All this of course adds to the rental of the tenantry, and as a consequence overcrowds the inferior class of tenements, where the inconveniences and dangers must be endured from sheer inability to pay the increased rental for superior and more healthful domiciles, by reason of a more abundant water supply.

House to house inspections, which I have made among this latter class, during the

summer months especially, constantly present the fact that the great amount of death and sickness occurring among children under 5 years of age, is very largely due to an insufficient water supply.

To preach cleanliness, frequent bathing, change of clothing and house scrubbing, to these poor people deprived almost of the use of water, except solely for culinary purposes, is like preaching to the ever befogged Londoner, that he must live in the bright sun light of Italy to be healthy.

Both would look at you in wondering amazement and ask how they could do it, when there is neither water nor sun to be had?

FREE PUBLIC BATHS.

There is another feature that an abundant water supply presents; one which has been recognized and urged by the City Authorities for several years past. The Tenement House Commission, appointed by the Legislature, in 1882, in its report makes a very strong recommendation to the Legislature to provide suitable free public baths throughout the tenement house districts, for the use of that class of our population, during all the months of the year. The enormous number which each summer shows, of people who avail themselves of the free floating baths, and who except in those summer months cannot bathe at all, and whose health is promoted thereby, should be a strong argument in favor of establishing free baths in those portions of the City. How much better would be the results of bathing in pure water, than bathing in our sewage polluted streams on both sides of the city and this too at all seasons of the year.

Health and physical strength would be gained and maintained.

With an abundant supply of water, our homes and houses, instead of becoming the hotbeds for propagating disease germs, would be purified and made healthful.

The so-called visitation of Providence by epidemic and contagious diseases would soon become things of the past; for it is a well recognized fact among all scientists and sanitarians that filth, moisture and warmth are the propagating media of nearly all these diseases.

Prevention is better than doubtful pharmacy cures, both to eradicate the causes and secure healthful conditions.

AN ABUNDANT SUPPLY OF WATER IS THE REMEDY

and to it we must look for more healthful conditions and surroundings, for a reduction in our high death rates and for a stronger and more vigorous race of descendants.

So obvious is the fact that an abundant and sufficient water supply is synonymous with health and financial prosperity, that statistics and arguments are unnecessary to convince any thinking mind of its value and necessity.

Every day's delay in securing this great boon to this City is *costing many lives and great financial loss*; and it is the duty of all in authority to promote and adopt any scheme that can give assurance of rapidly accomplishing this most desirable result.

The subject enlarges itself upon every hand the more we think and study upon it;

and I might mention one more pregnant fact in favor of a free and abundant supply—our public sewerage system is by far one of the most dangerous conditions of unhealthfulness to the city.

During the hot summer months there is but comparatively but little rain fall to flush out these long and many times circuitous public conduits. In consequence accumulations not unfrequently occur in their courses, of rapidly decomposing animal and vegetable refuse, producing those offensive and poisonous so-called sewer gases, causing all sorts of what is termed malarial disease. Chemistry nor microscopy have succeeded in defining what these gases are definitely. But it is sufficient to know they are the products of decomposition and that this decomposition is the direct result of lack of water carriage to remove these accumulations.

Many suggestions have been made and advocated to ventilate and flush these hotbeds of disease. No better plan could be devised than by providing an abundant water supply, so that during the summer months the more free use of water for household purposes and for flushing house drains and sewer connections would cause an abundant and free flushing of all the public sewers.

With the hope that these few crude suggestions may be of use to you, and regretting the inability to enlarge upon the theme for want of time upon which so much can be said, and upon the truth of which no argument in opposition to it seems to me could prevail, and hoping that such measures may be very soon adopted that this city can be supplied almost continually with pure water.

Yours truly and sincerely,

MOREAU MORRIS, M. D.

Sanitary Inspector in charge of Public
Institutions and Schools, and formerly
Sanitary Superintendent of Health
Department.

I hereby concur in the opinions above expressed by Dr. Morris,

STEPHEN SMITH, M. D.

Late Health Commissioner.

CHARLES E. LOCKWOOD, M. D.

Late Sanitary Inspector N. Y. Health
Department, from 1873 to 1888.

The points made by Dr. Morris are excellent and cannot be controverted

CYRUS EDSON, M. D.

Chief Inspector Contagious Diseases,
Health Department, City of New York.

ROGER S. TRACY, M. D.

Register of Records of Vital Statistics.

E. H. JAMES, M. D.

Assistant Sanitary Superintendent,
Health Department, City of New York.

NO. 2 WALL STREET, NEW YORK,
December 20th, 1888.

TO THE COMMISSIONERS OF THE SINKING FUND
OF THE CITY OF NEW YORK.

GENTLEMEN :

I have the honor to submit to you herewith a letter from
PROF. C. F. CHANDLER OF COLUMBIA COLLEGE,
and a report on the sanitary condition of this city signed by

DR. MOREAU MORRIS,	DR. CYRUS EDSON,
DR. STEPHEN SMITH,	DR. ROGER S. TRACY,
DR. CHARLES E. LOCKWOOD,	DR. E. H. JAMES,

showing the great need of an additional and abundant water supply delivered into the lower part of the city under pressure sufficient for high service.

And I also respectfully submit for your further consideration the following facts and reasons why an abundant supply of water for the protection of this city should be secured as quickly as possible.

From the able report of B. S. CHURCH, Chief Engineer of the Aqueduct Commission, dated October 22nd, 1888, I quote the following instructive facts touching the present and future supply of water that may be expected from the Croton basin years hence when all the storage reservoirs not yet commenced have been completed.

***** To find the daily supply which the city requires for any year multiply the daily per capita consumption by the population for that year, as given in Table 1.

TABLE No. 1.
Population.

Year.	Population.	Year.	Population.	Year.	Population.
1880.....	1,206,577	1885.....	1,397,395	1890.....	1,617,766
1881.....	1,242,533	1886.....	1,438,937	1891.....	1,665,875
1882.....	1,279,560	1887.....	1,481,817	1892.....	1,714,518
1883.....	1,137,691	1888.....	1,525,965	1893.....	1,765,610
1884.....	1,356,958	1889.....	1,571,438	1894.....	1,818,225

The above table is based upon the actual increase of population between the State census of 1875 and the United States census of 1880, equivalent to an annual rate of 2.98 per cent. of annual increase. Of the daily supply of 158 million gallons, 20 million gallons will come from the Bronx, leaving 138 millions to be drawn from Croton. *****

Thus, according to the statistics above given, it is clearly demonstrated that the consumption of 138 million gallons per day will exhaust the storage of 1890. Not only will the storage be exhausted, but the daily supply will be short by 79 million gallons. This will be evident when you multiply the population of 1891, amounting to 1,665,875, by the consumption per capita of 143 gallons, which equals..... 238,220,125

Supply of Croton.....	138,614,277
Supply of Bronx.....	20,000,000
	<hr/> 158,614,277
Leaving.....	79,605,848

"On 238 million gallons, less 158 millions of consumption, leaves 79 million gallons as the amount of demand exceeding the supply which could be furnished by the added storage of Sodom Dam and the present Croton Lake per day.

"The figures here given are based upon a moderate estimate of consumption per capita, when compared with the figures reached in other cities, where the pressure in street-mains is not restricted, and where house-plumbing and street-pipes are not in so bad a condition as in New York. Chicago consumes 160, Buffalo 153, and Washington 145 gallons per capita. The plumbing in the upper stories of over one-half of this city has been empty, unused and unrepaired for the past fourteen years, and when again filled, it will be a slow and laborious effort on the part of the Water Department to force owners to repair leaking fixtures. The older street-pipes also will leak when subjected to higher pressure, after being years without. Therefore, no city in the country is in a condition to consume more water per capita than New York when the pressure is restored.

"The following facts may enable the Commission to realize what the demand for water will be when the pressure is re-established. *Since 1875 the population has increased in the ratio of 2.98 per cent., based on the census returns of 1875 to 1880, advancing from one million of inhabitants in 1875 (when the consumption reached the maximum supply) to one and one half millions in 1888. One half a million of consumers has been added, and the city has been growing on its horizontal plane and vertically in high buildings, while the water supply has been practically standing still during the past thirteen years. The ten million gallons increase per day from the Bronx was but a drop in the bucket. In 1878 the six 48-inch gates in the 48-inch pipe-mains which feed the city from the Central Park Reservoir were open 48 inches, giving their full flow to the city. At that date the exact balance was reached between supply and consumption. To-day, in 1888, these same 48-inch gates are open but 2½ inches on an average, and yet the city is so fierce in its demands that it is dragging a greater amount of water through these small apertures than in 1875 through the wide open gates. One need but stand on one of these iron pipes in the Gate Chamber to feel the vibration, and hear the diaphanous hum as the water struggles through the throttled gates, to realize what the city would use if these gates were fully open as in 1875.*

"The sole object of the New Aqueduct Storage Reservoirs and appurtenances now being constructed is for the purpose of opening the gates and giving back full pressure, which the short supply has made impossible for the past fourteen years. Not to provide sufficient storage to produce such a result would be like partially curing a sick man in order to economize the medicine.

"It is necessary to build the Quaker Bridge Dam immediately, because all its storage, in addition to that of the Sodom Reservoir and Croton Lake, will be required at the date of its completion, in order to open the pipe-gates, and give back full pressure to the city.

"As given in my reply to Colonel McLean's report, and as stated above, it is not safe to estimate on a less rate of daily consumption than 143 gallons per capita. *If the Quaker Bridge Dam is commenced next spring it will probably be completed in 1894. The population, as shown in Table 1, will be 1,818,225. Multiply this by the per capita consumption of 143 gallons and the city will require a daily supply of 260 million gallons per day. * * * * **

THE RATIO OF ANNUAL INCREASE OF POPULATION SINCE 1880 GREATER THAN 2.98 PER CENT.

TIME REQUIRED TO CONSTRUCT THE QUAKER BRIDGE DAM.

The growth of this city since 1880 has been at a much greater ratio than 2.98 per cent. per annum, the rate previous to 1880. Expert investigations the past six months indicate that the population of the city at the present time, including the annexed district, which is to be supplied from the Croton water-shed, exceeds the result reached by applying the rule of increase between 1875 and 1880, which makes the population for this year 1,525,965 when in reality it is much greater, the indications are that in 1894, the year that Mr. Church says the Quaker Bridge Dam will probably be completed, the population instead of being about 1,800,000 will be nearer 2,100,000 and will require at that time more water for all purposes than the Croton basin will yield during dry years after the storage reservoirs proposed have been completed.

Gen. Newton, Commissioner of Public Works, stated last summer before the Fassett Investigating Committee as follows:

"MR. NICOLL:—Did you ask the general how long it would probably take to construct it? (the Quaker Bridge Dam)"

"WITNESS—(Gen. Newton) Five or Six years."

As the Quaker Bridge Dam has not yet been commenced, this will carry the date of its completion to 1896, when the population will be still greater, say at least 2,300,000, which at 143 gallons per capita would require 328,000,000 gallons daily, which exceeds the available capacity of the Croton basin after all the storage reservoirs proposed to be built are completed, even during years of average rainfall.

When all this has been accomplished—say in ten years from now—and the volume of water and pressure restored in Central Park Reservoir so that the gates can be opened into the distribution pipes, one of two things will then be required to maintain the pressure against an ever increasing draught, either the building of additional mains to the lower part of the city, or raising the Central Park Reservoir to a higher elevation to afford head pressure, which of course is impossible except by pumping the whole amount of water used. If this is not done it will be "history repeating itself," the pressure will begin to recede again as the demand increases thereafter.

LEGISLATIVE RESPONSE TO COMPLAINTS FOR MORE WATER.

The Senate, on the 9th. of November, 1883, expressed itself, in the preamble to the resolutions authorizing the Mayor of this City to appoint a Committee to consider the pressing wants of that year for more water, as follows:

"WHEREAS, with the return of business prosperity the rapidly increasing growth of the City of New York causes a constant increase in the complaints which have prevailed for years past, that, by the insufficiency of the City's water supply, the people are deprived of the ordinary conveniences of domestic life, the public health is endangered, the security of property from fire diminished, and the pursuit of commerce and manufactures is retarded."

The Committee appointed by the Mayor recommended the construction of a New Aqueduct and stated it could be built in two and a half years. It was commenced in 1884; more than four and a half years have since then been occupied in its construction. It is not yet completed and the storage reservoirs necessary to an increased supply not yet commenced. The situation, critical in 1883, is much worse to-day; no additional water has been secured, nor is likely to be from the Croton water-shed for many years to come as hereinbefore stated, except during the storm months.

THE INCREASE IN POPULATION AND WEALTH

continues at an amazing speed and indicates that when the Storage Reservoirs are completed in 1896, the City will be in the same relative position of supply and demand as it was in 1883. The present need for more water is daily increasing; the fire department, the fire underwriters, the Produce Exchange, the military, medical and sanitary

authorities, merchants and citizens all now ask that more water be procured quickly, from a source independent of the Croton water-shed, delivered into the lower part of the City, that the incalculable benefit of a dual supply may be secured.

It is difficult to estimate the reasonable requirements of this rapid increase of population. We do not build large enough to meet the demands even of the present; but now we are called upon to meet the demands of this constant accumulation and to provide in some degree for the future. The growth of this City is not comprehended by the people at large. The records show that one half of the export and nearly three-fourths of the import trade of the United States is carried on at this port. This marvelous growth creates new and larger demands for that prime necessity of life and health—an abundant supply of pure water—the best insurance the City can have for its safety and the protection of its wealth and credit.

LARGE INCREASE IN THE NUMBER OF CITIES SUPPLIED BY PRIVATE CORPORATIONS.

Some objection by interested parties has been made to the City contracting with a private corporation to supply it with water; no substantial reasons are given for none exist. The facts are all the other way, as of the 1900 water systems in this country one-third are owned and operated by cities and towns themselves and two-thirds are owned and operated by private corporations supplying the cities and towns with water, and the proportion of private water companies is increasing yearly, for the reason that they give better service, better water, at less cost, and insure municipal freedom from political jobs, corruption and waste, and consequent debt and increased taxation, the certain result when the city supplies itself.

THE COST OF WATER TO OTHER CITIES.

In a review of the costly and elaborate returns of local governing boards, the St. James Gazette of London states, that £25 (\$121.00) per million gallons is a low average for the cost of the English water-supply, only falling below £21 (\$101.64) or £22 (\$106.48) in a few places where ample flow is provided from unsullied rivers or artesian wells.

The actual cost in some of the larger places is as follows:

CITY.	COST PER MILLION GALLONS.	COST IN U. S. CURRENCY.
London	£30	\$145.20.
Liverpool	£34	\$164.56.
Sheffield	£35	\$169.40.

A comparison of the relative amount charged for water to the ratable value of the houses supplied shows the cost is much higher in towns supplied by municipal authorities than where served by private companies.

COST OF WATER LESS WHEN SUPPLIED BY PRIVATE CORPORATIONS.

From the same eminent authority, a careful analysis, which was made in 1884, of all the various water systems in the United Kingdom from whom reliable returns could be secured, showed that the percentage of cost of water to the consumer, on the ratable value of the houses supplied, was much less in cities supplied by private corporations than in cities supplied by themselves, as follows:

The City of London, the largest commercial City in the world, is wholly supplied by private corporations, the charge for water amounting on the ratable value of the houses supplied, to 4.79 per cent.

In the City of Liverpool which owns and operates its own water supply system, the rate is 6.74 "

In Manchester, which owns and operates its own water works 7.73 "

In Birmingham, owning and operating its own water works 7.71 "

In Wolverhampton, which owns and operates its own water works . . . 8.5 "

The cost of water to many cities in the United States is very low because of their favorable location to sources of supply. Chicago is situated on an inland sea of fresh water and has only to pump to an elevation sufficient to insure good distribution through the streets and into the houses, but the cost of doing this exceeds \$30 per million gallons. All of the other lake cities are more or less favorably situated, the cost of supply varying with their distance from the shore line and head pressure required by pumping to insure perfect distribution. It is difficult to get accurate figures showing the full cost in all cases because of the rapid growth and the constant change that is going on to meet the increased demands for more water, the additions required and extensions being made each year, and the manner of keeping accounts in all our large cities with only two exceptions where the method of bookkeeping in the water department was regulated by law. The cost is dependent upon location and population, from lake cities—the lowest,—to cities like Boston, Baltimore and other places, where the cost exceeds \$100 per million gallons.

The amount of water used by various cities in this country, like the cost, varies greatly, dependent upon the location of the city, its population, elevation, the grade of its sewerage system, and the amount of the water supply available. Mr. Church, in his report, states that Chicago consumes 160, Buffalo 153 and Washington 145 gallons per capita, and also that "no city in the country is in the condition to consume more water per capita than New York will be when the pressure is restored," and names 143 gallons per capita as the estimated amount that will be consumed. There is no reason why the per capita consumption of water in New York City should be any less than in Chicago. On the contrary, there is every reason why it should be much more; the reason set forth by the sanitarians of this City viz. the water carriage system of sewerage requires a larger volume of water to flush and wash the sewers in this city because of the grade and circuitous route in so many cases.

I know it has been stated that a less amount per capita is sufficient for this City, but all such statements are made either regardless, or in ignorance of the facts, actual conditions and wants of the City of New York. The local conditions and wants of cities regulate all such supplies, some require much more than others. New York City, because of its location, topography, its system of sewerage adopted, its high buildings, crowded tenement houses, and wretched sanitary condition, resulting from such crowding, can only be improved, cleansed, made healthy and prosperous by an abundant supply of water. We need all we can get; 200 gallons per capita is not too much. If we had that amount it would be a wise and economical provision and not waste. The City would be the gainer in health and money. No better reason can be given for the necessity of the use of an abundant water supply in this City than a perusal by your Honorable Board of the report by the Health Department recently compiled, giving the

CENSUS OF THE TENEMENT HOUSES OF THIS CITY,

from which I note the following. During the six months ending December 8th, 1888, 856 tenements have been built; the population has been increased 63,303 persons; the total tenement house population now is not far from 1,100,000, or only about 500,000 less than the City's estimated population. It is shown that the City contains 32,200 tenements, there being 13,220 below 14th street; the downtown tenements containing more than 63,000 children under 5 years of age, the number in uptown tenements being much greater.

THE CASH VALUE OF HUMAN LIFE TO THE COMMUNITY.

During the year 1884, in about 30 large cities in the United States, having an aggregate population of 7,014,677 there were registered 154,525 deaths, giving an annual mortality of 22.0 per 1,000. In 1883, the rate was 22.2. The death rate was highest in the eastern cities where the water supplies are not so abundant, being 23.1, and was the lowest in the lake cities, being 19.1, where good water is provided in ample quantity; the death rate of New York City in the same year being 25.82 per 1,000.

For every 1 per cent. reduction per 1,000 inhabitants in the death rate of New York City there is a saving of at least 1,500 lives; and if the death rate in 1887 had been the average of the 30 largest cities in this country in 1884, viz. 22.0 per 1,000 there would have been a saving of human lives in this city, as follows:

YEAR.	DEATH RATE PER 1,000 IN NEW YORK CITY.	EXCESS OVER AVERAGE DEATH RATE OF 22.0 PER 1,000.	NUMBER OF LIVES LOST IN NEW YORK IN EXCESS OF AVERAGE DEATH RATE IN 30 LARGEST CITIES IN U. S.
1884	25.82	3.82	5,730
1885	25.53	3.53	5,280
1886	25.96	3.96	5,940
1887	26.27	4.27	6,500
1888	about 27.00	5.0	7,500

A total in the last five years of 30,950

The foregoing table shows that during the past five years 30,950 people died in the City of New York, in excess of the natural or average death rate ruling in all the other large cities of this country. These lives were lost principally by what sanitary experts and physicians generally class as preventable diseases occasioned principally by the inadequate supply of water and the violation of sanitary laws resulting therefrom. The sanitary report accompanying these papers inform us

“That the death rate of this City is increased by an insufficient supply of water can hardly be doubted; and when comparisons are made with other cities provided with an abundant supply, the fact becomes patent to any unprejudiced person, that the high death rate of this City would become much less with an abundant supply of water, almost goes without saying, especially among sanitarians.”

It is true that the crowded condition of New York and the inflowing tide of immigrants at this port tends to increase the death rate, but the City is so favorably situated that, with an abundant supply of water delivered under pressure of 300 feet head to all parts of the City there is no reason why the atmosphere should not be pure and wholesome even in the crowded districts, and the death rate reduced to 22, or even 18 or 20 per 1000.

To ascertain with accuracy the cash value of a human being to the community—man, woman or child—at all ages and in every class, so as to cover completely the conditions existing in this City, I had recourse to vital statistics; a close study of which soon revealed the fact that the value of lives in this country is greater than in any other civilized country on the globe. The English works on vital statistics cover a greater number of years, are more accurate, and embrace all conditions of life, all wage earners in every occupation, of both sexes. The most noted work on the economic value of populations and the highest authority in the world is without doubt the statistical writings of William Farr, M.D., D.C.L., C.B., F.R.S., the late superintendent of the Statistical Department of the Registrar General's Office, England, whose official experience covered nearly 40 years. This work of the Registrar General's Office, edited by Noel A. Humphreys, was published in 1885 by the Sanitary Institute of Great Britain. The article on the

ECONOMIC VALUE OF POPULATIONS,

drawn from recorded facts, is so admirable and comprehensive that were it not so long I would quote it entire, but I select from it the following:

* * * * * *The value of the population itself is the most important factor in the wealth of the country.* * * * * *

“It will be sufficient to state here that the capitalization of personal incomes always proceeds upon the determination of the present value at any age of the *future annual earnings* at that and all future ages; hence the value of future wages rises from the date of birth, when it is a notable quantity; is highest in the laboring classes at the age of 25, and declines as age advances, until in extreme age, when no wages are earned, it disappears. The living by the Life Table are most numerous in childhood, and gradually fall off till they are all extinct; and so in the population enumerated at the Census the numbers decline from the first year to the ultimate years of age. While the rates of wages rise rapidly from birth to the age of manhood, and afterwards decline, the numbers living constantly decline. Taking a series of observations on the wages of agricultural laborers some years ago at different ages; determining their value by a Life Table at five per cent.

rate of interest for each age; and multiplying the numbers living by these values, *it is found that the mean gross value at all ages is £349.* But the mean value of the subsistence of the laborer as child and man, determined by the same method, is about £199; and deducting this sum from £349, there remain £150 as the mean net value of the male population, estimated by this standard of the *agricultural laborer.* * * * *

"The minimum value of the population of the United Kingdom, men, women and children, is £159 a head; that is the value inherent in them as a productive, money-earning race. * * * *

"Should the population of a country decay, the value of its capital might sink to the vanishing point.

"What I wish further to point out is that during the 39½ years this office has existed there have been added to the population of the United Kingdom, 7,619,759 people who, valued as land is valued by the annual yield and net profit, constitute an addition of £1,212 million to the wealth of the nation." * * * *

"Valuing the emigrants as the agricultural laborers have been valued at home—taking age and service into account,

THE VALUE OF EMIGRANTS

in 1876 was £175 per head. Apply this standard to the whole period it will follow that the money value of the 8,000,000 people that left England, Scotland and Ireland in the years 1837-76 was £1,400 million, or on an average about £35,000,000 a year." * * * *

"It is evident that there are other elements on which the economic value of the working population depends; and foremost among them stand *health and long life.* *The longer men live, and the stronger they are, the more work they can do.* Epidemic diseases in rendering life, render wages insecure. * * * *

Other epidemics have since been fatal especially to children, and fever has struck at princes and peers as well as peasants; but upon the whole *the great zymotic diseases have been quelled.* Plague in its various forms has been kept at bay by a series of defences based upon minute precautions. In some epidemics I found it necessary to publish daily particulars respecting deaths in the Metropolis. *By pursuing such inquiries, year after year, not only many of the causes that induce sickness and destroy life have been discovered, but observations of the same kind have shown that their removal has been followed by health and longer more vigorous life.* The economic value of the population of several towns has been increased by sanitary measures. *The truths established, the facts ascertained, the evils discovered in the thirty-nine years past await their full administrative applications in the years to follow; and the savings of time wasted in sickness, as well as of precious lives prematurely lost in youth and manhood, will enhance the value of the population to an incalculable extent.* * * * *Every improvement in health recorded makes it clearer and clearer that the gloom of sickness and premature death flies away before sanitary measures.* * * * *The result on human happiness cannot be calculated; but a future Industrial Census will show in a very definite shape its effect in raising the economic value of the population.* The mean lifetime by the English Life Table is 49.86 years; by the Healthy Life Table it is 49.0 years, which is attainable in every well organized State. *It is fair to assume that if a fifth part be added to the mean lifetime at least a fifth part will be added to the worth of a living and laboring population.* Upon this estimate £1,459 million will be added to the economic value of the population of the kingdom. *Its value will increase with its numbers, and so will the value of its emigrating thousands.*—(39th Annual Report, pp. VI.-X.)

The above able authority shows that the gross value at all ages of the population in Great Britain is £349, and that the minimum value of the population, men, women and children, is £159 a head, that *is the value inherent in them as a productive money earning race.* This is the equivalent under like conditions in this country of 795 dollars for each life, but as the productive value of wage earning capacity in this country is at least thirty

per cent greater than in the United Kingdom, which added makes the value in this country the equivalent of at least \$1,200. The laws, however, in many States of the Union have fixed \$5000 as the cash value of a human life when killed by accident on railroads or otherwise as the measure of damage or loss sustained.

At the Sixteenth Annual Meeting of

THE AMERICAN PUBLIC HEALTH ASSOCIATION,

held at Milwaukee, Wis., Nov. 20, 21, 22 and 23, 1888, representing every State in the Union and the Provinces of Canada, Dr. Crosby Gray, of Pittsburgh, Pennsylvania, read a paper on the contamination of the water-supply of a portion of that City by surface drainage. The death rate in this portion of Pittsburgh, (the south side,) was higher than that of the rest of the City, and typhoid fever had been very prevalent there. An investigation proved that the water-supply, drawn from the Monongahela, was being seriously, steadily and increasingly polluted by sewage, factory refuse and by bumboat nuisances; and that the epidemic in question had been caused by the sudden downwash, through rain water surface drainage, of typhoid excrements from certain gulleys far above the intake, the disease having for some time been endemic in those localities in a small way.

In the course of his remarks, he called attention to the following facts:

"The cash value of a human life to the community has often been computed, and it is a moderate estimate of the average value of the 260 lives lost on the south side, over and above its just percentage of the current death-rate in Pittsburgh, at \$1,275 each, or..... \$331,500
together. To this should be added the burial expenses at \$50, or..... 13,000
in all. But as for every death there are many ill who recover, it would be a juster estimate to capitalize the sick at ten times that of the death rate. That would mean 2,600 people ill. The average time these persons would be compelled to remain unemployed would be, say 30 days. This would give us 78,000 days' work lost. From this deduct 15 per cent for those below the productive period of life, which would leave 66,300 days lost. Averaging the value of a day's work at \$1.25, the total loss in productivity would be..... 82,875
"Add a quarter to this sum, on the basis of but 31 cents per day, for otherwise productive time devoted to nursing, etc., that amounts to..... 20,718
more; to which should be added certainly not less than \$2 per case for medicine, i. e. 5,200
more. And finally there should not be forgotten the legitimate profit (say, one-third a day's wages) on its putative product to wit, all of..... 27,625
more. These amounts tally..... \$480,918
per annum, which, literally fatal waste, might be stopped once for all by the establishment of an improved water-service, drawing its supply from unpolluted sources one hundred miles off, by the timely and wise investment of this sum for two or three years."

The above citations show that the minimum value of human life to the community computed from the mortality records of both sexes, at all ages and under all conditions, under the law of general average is

In Great Britain.....\$ 795.00
In the United States.....\$1,325.00

Therefore it follows from the evidence presented that at the present high rate of mortality which prevails in the City of New York, set forth in the records of Vital Statistics, about 7,500 people have lost their lives the past year from preventable diseases, caused by a lack of public water supply.

The financial loss to the City of New York, resulting from preventable deaths and sickness, is as follows:

Annual loss to the city in wealth by preventable deaths as per above table, 7,500 lives at \$1,325 each.....	\$9,937,500 00
Annual loss from preventable sickness, as shown by experts, ten cases of sickness to one death;	
Loss of labor 75,000 cases, 30 days at \$1.25 per day	\$2,390,625 00
Loss of time devoted to nursing, etc., add one-fourth more.....	597,655 00
For medicine, 75,000 persons, at \$2.00 each.....	150,000 00
Loss of profit on labor lost, one-third of day's wages	796,875 00
	<hr/>
Total loss per annum from preventable death and sickness in New York City.....	\$13,872,655 00

This amount of loss will increase each year hereafter until an abundant water supply under pressure is secured. Then this large amount now being annually lost, will be saved to the City, and the water department will receive a largely increased revenue from sale of water to new users who are not now supplied, because they cannot get it. Furthermore there are hundreds of people in this City who pay water rents to the department who receive but little if any water. To these parties you will be able to deliver what they pay for, which you cannot now do.

The foregoing is not theory, but the direct evidence of recorded facts, which can neither be refuted nor ignored; facts which show that the millions lost each year would be saved with an abundant water supply, the cost of which would only be a fraction of the amount saved. The death rate and losses incident thereto will increase each year until the remedy is secured, an abundant supply of water delivered into the lower part of the City, under pressure sufficient to flow to the higher elevations.

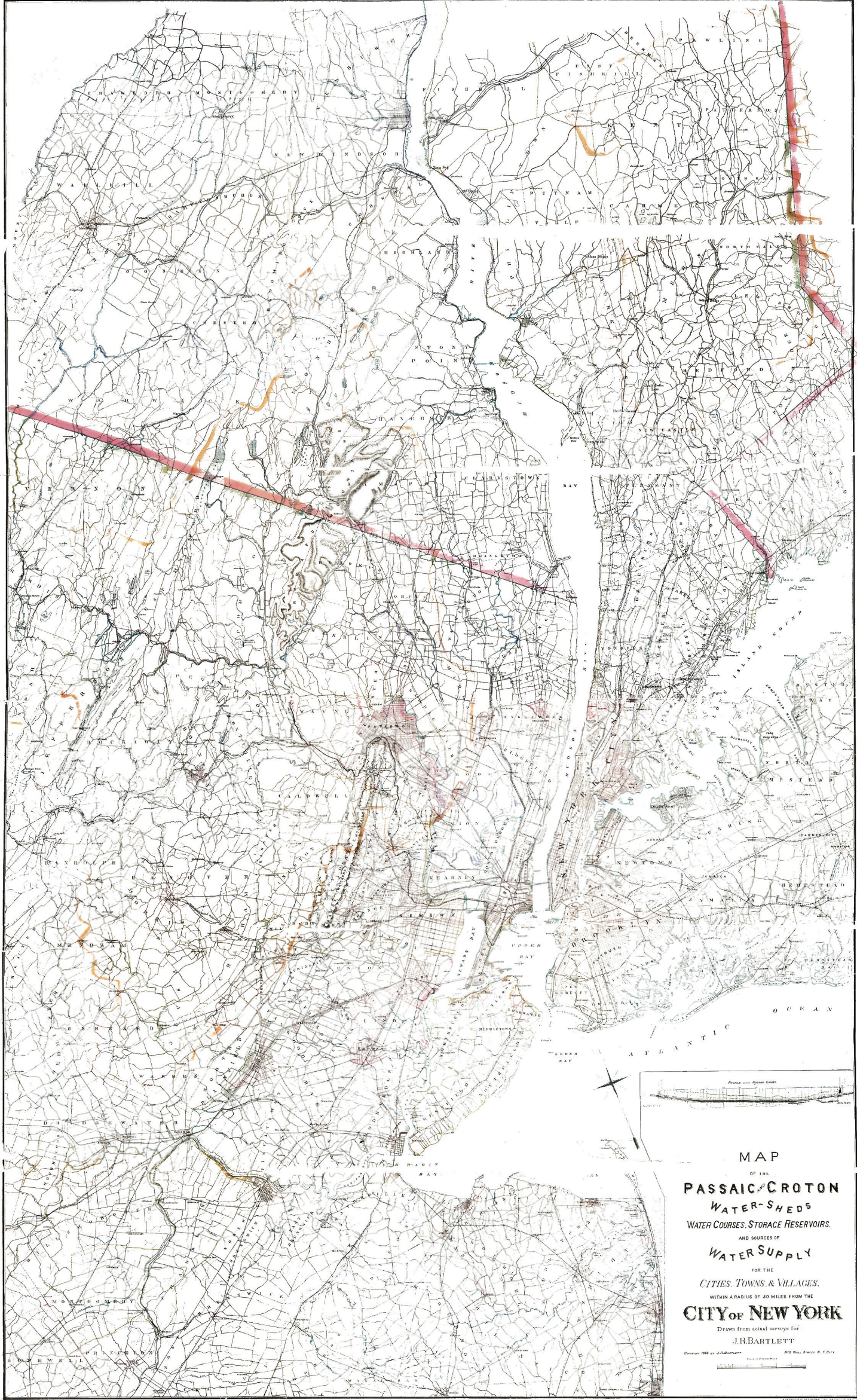
Sanitarians and physicians tell us that, until this is secured, the City is liable to epidemic from typhoid and other preventable diseases, which would sweep away additional thousands and injure our City as a place of residence; and fire underwriters tell us that we are liable to destructive conflagrations from the same causes that would sweep away millions of property in a single night, thus touching the pockets of the rich as well as the poor. Restricted use of water is waste of life, health and money. In the larger and more abundant use of pure water only is true economy. It will save in this City a hundred fold its cost in life, health and happiness and in money ten-fold. A corporation, business firm or individual, would not hesitate to act quickly in securing a compensation

so large for an outlay so small. Your Honorable Board, are the chosen officers of the great corporation of the City of New York, charged with the management of its financial affairs, and by special legislative authority you are clothed with full power to obtain an auxiliary supply of pure water, from a source independent of the Croton water shed, under contract, from the district, in the quantity and under the conditions named in the proposition of myself and associates, the acceptance of which by you will insure to the City immunity from epidemics and destructive conflagrations, and consequent depreciation of assets, and add yearly to the wealth of the community ten times the cost of the water, and to the attractions of the City as a place of residence.

Submitting the foregoing facts and conclusions for your consideration, I have the honor to be,

Yours respectfully,

J. R. BARTLETT.



MAP
OF THE
PASSAIC & CROTON
WATER-SHEDS
WATER COURSES, STORAGE RESERVOIRS,
AND SOURCES OF
WATER SUPPLY
FOR THE
CITIES, TOWNS, & VILLAGES,
WITHIN A RADIUS OF 50 MILES FROM THE
CITY OF NEW YORK
Drawn from actual surveys for
J. R. BARTLETT
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From SCIENCE of December 14th., 1888.

THE POLLUTION OF WATER-SUPPLIES.

DR. CHARLES SMART, Surgeon U. S. A., presented a report at the recent meeting of the American Public Health Association on the pollution of water-supplies.

The report gives special emphasis to the conclusion reached at the previous meeting, that, when there is sewage in a water-supply, there is danger of typhoid infection. Some of the evidence is briefly cited; and financial interests involved are held responsible for the hesitancy to acknowledge this specific danger, for as soon as a city relieves itself from the oppression of the moneyed interests, and procures a wholesome water for its citizens, it immediately recognizes the connection between sewage and typhoid. Vienna recognized this connection when it found that, by substituting the water of a mountain-stream for the sewage-water of the Danube, its annual deaths from typhoid fell from three hundred and forty to fifty, and shortly afterwards to eleven, in every hundred thousand of the population; and an improved sewage system had nothing to do with this, as the sewage system was in existence during the period of high typhoid rates.

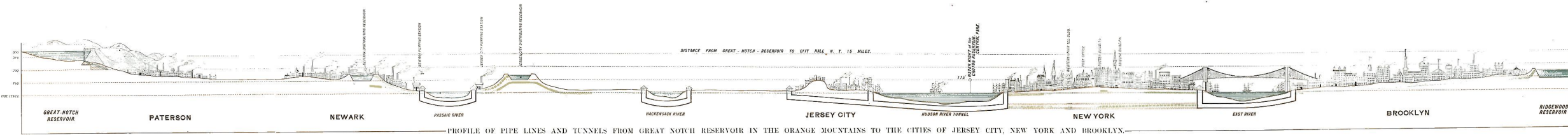
The efforts made by municipal authorities and water companies are then passed in review. The advantages of sedimentation, which is the method generally adopted in this country, are recognized, and particularly when sedimentation is prompted by the use of precipitants, such as chloride of iron, as recently suggested by L. H. Gardner, of New Orleans, La. The changes that take place during storage are held to be purifying in their nature, notwithstanding the vast increase in the number of bacteria developed in the stored waters. The slowness of the sedimenting process, often necessitating a large expenditure for storage-basins, has led to the experimental use of such filtering beds as are employed so generally for municipal supplies in England; but the expense attending them is large, and the coldness of our winters begets difficulties which are not encountered in the milder climate of England. Attention is then directed to the patent filters that have of late been manufactured for use on a large scale. Their ability to furnish a clear water is conceded; but the object of the filtration of a water-supply for domestic or public service is its wholesomeness when used for drinking, and its transparency gives no testimony on this point. Artificial filtration has neither the time nor the surface to effect percolation after nature's methods. In these artificial filters, as much water is transmitted under pressure in half an hour as nature purifies on the same area annually. Bacteria of nitrification, which effect the purification during the passage of a water through the soil, cannot be harnessed to the work of the artificial filter. Artificial filtration consists of the mechanical separation of a water from its suspended impurities, while the essential of natural filtration is the thorough nitrification of the dissolved albuminoids of the water, the removal of the suspended matters being incidental and merely secondary.

But although sedimentation and filtration give a more or less clear water, and one in which the organic matters that are prone to decompose are destroyed and rendered harmless by bacterial agencies, if an infected sewage has entered the water, the living germs of typhoid fever are not removed or deprived of their virulence by any of these modes of purification. The infected water which prostrated twelve hundred of the eight thousand inhabitants of Plymouth, Penn., and killed a hundred and thirty of those whom it prostrated, passed through three storage-reservoirs on its way to accomplish its deadly mission; and the springs of Lauzun, in Switzerland, contained the germs and propagated the disease, although their waters had undergone a thorough filtration. From the particulars of the latter epidemic, it is held, that, while sewage irrigation may give effluents that will preserve our streams from becoming open sewers, it will never furnish a water which can be afterwards used as a drinking-supply.

The conclusion reached is an emphasized reiteration of that of every committee which has investigated this subject,—that a water to which sewage has had access should, from that fact alone, be excluded from all further consideration as a possible water-supply for domestic purposes. Money is held to be all that is wanting to solve the question of pure water-supplies. Engineering difficulties fall into insignificance when surveyed from a satisfactory financial standpoint. It is often said to be beyond the power of money to purchase health, but the sanitary student can readily demonstrate that in many cases this is not so. Money expended in the distribution of a wholesome water-supply will purchase health for the thousands who otherwise fall victims to the fever which is endemic in our cities and towns. * * * * *

The germ of disease may not be in this pitcherful or in that, in this tumblerful or in that, but it will find us some day, if we continue to use the water which contains it. In a town of fifty thousand inhabitants, one victim is taken daily; and, as the average duration of this fever is about a month, there are always in that city thirty persons whose lives are unnecessary trembling in the balance. What is the local suffering from yellow-fever in Jacksonville, Pensacola, or New Orleans, once in so many years, compared with the totality of the devastation caused by the steady progress of this general and ever-present scourge? Thirty thousand people die of typhoid fever annually in the United States of America; and Vienna lowered her losses by this fever from three hundred and forty to eleven annually in every hundred thousand of her population, by introducing a spring-water supply instead of the sewage-tainted waters of the Danube. Calculate the loss by sickness associated with these thirty thousand deaths,—the loss of work, the unprofitable work of nursing, and the actual outlay necessitated by each visitation of the disease,—and you will find that saving money by drinking sewage in the water-supply is a penny-wise policy, that, in the long-run, will fail to pay even for the funerals and mourning goods.

The importance of acting promptly is insisted upon, as the longer a community procrastinates, the greater is the difficulty experienced in procuring a desirable supply of water, owing to the increasing density of the population of the surrounding country.



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